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REPORT ON COOSA RIVER SYSTEM
GEORGIA-ALABAMA

ROBERT A. TAFT SANITARY ENGINEERING CENTER
CINCINNATI, OHIO

JANUARY 1963

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The August 1962 stream surveys evaluated interstate pollution of the Coosa River System, and local pollution problems requiring correction were also observed. Data were gathered on water uses, including hydroelectric power, water supply, and recreation. Principal waste discharges were examined for these rivers: Chattooga, Etowah, Oostanaula, and Coosa. Organic and bacterial pollution data are reported, along with information on silt pollution and road bank and soil erosion. Tabular data are appended.

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Alabama
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Organic wastes
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REPORT ON COOSA RIVER SYSTEM

GEORGIA-ALABAMA

U. S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
PUBLIC HEALTH SERVICE
ROBERT A. TAFT SANITARY ENGINEERING CENTER

CINCINNATI, OHIO

JANUARY 1963

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FOREWORD

The field survey was directed and the report prepared by A. W. West, Public Health Engineer.

The biological studies were directed and the biological section of the report written by K. M. Mackenthun, Biologist.

Data was processed by C. E. Runas, Senior Assistant Sanitary Engineer, who was Assistant Project Engineer during the survey and report preparation.

The work was performed under supervision of F. W. Kittrell, Engineer-in-Charge, Pollution Evaluation Unit, of the Field Operations Section at the Robert A. Taft Sanitary Engineering Center in Cincinnati, Ohio.

Valuable assistance, cooperation and contributions were generously provided by others on the staff of the Robert A. Taft Sanitary Engineering Center, Atlanta Regional Office, Alabama State Water Improvement Commission, Georgia State Game and Fish Commission, and other participating agencies.

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BACKGROUND

The Coosa River, formed by the confluence of the Etowah and Oostanaula Rivers in Rome, Georgia, flows westerly across the State and into the State of Alabama. The Chattooga River flows southwesterly through the State of Georgia and joins the Coosa River System in the State of Alabama some 22 miles below the state line. The power dam constructed near Centre, Alabama, by the Alabama Power Company in 1961 impounds these waters to form the Lake Weiss reservoir.

These waters produce hydroelectric power, form recreational areas for the enjoyment of fishing, swimming, and other water sports, and are used as sources for domestic and industrial water supplies. They are also used for the disposal of domestic sewage and industrial wastes.

During recent years an increasing number of complaints allege that pollution of these waters is interfering with recreational use, retarding the development of potentially valuable lake shore property, and damaging the appearance and general aesthetic appeal of these rivers and upper Lake Weiss.

In addition to complaints by fishermen, lake side business and property owners, and individual civic-minded citizens in both states, resolutions condemning this alleged pollution and calling for effective pollution abatement measures have been passed by the following communities and organizations:

Floyd County Wildlife Association (Georgia)
Chattooga County Wildlife Club (Georgia)
Cherokee County Industrial Committee (Alabama)
Cherokee County Board of Revenue (Alabama)
Cedar Bluff, Alabama, Chamber of Commerce
Town of Cedar Bluff, Alabama
City of Centre, Alabama

Furthermore, large numbers of fish have been killed by pollutional wastes discharged into these streams. Reports on four recent fish kills, investigated by the Georgia State Department of Public Health and the Alabama Water Improvement Commission during 1961 and 1962, are summarized as follows:

Coosa River - On October 18, 1961, a small number of fish were killed by a temporary discharge of untreated paper mill waste from the Rome Kraft Company.

Oostanaula River - On July 20, 1962, large numbers of fish were killed by the accidental discharge of approximately 9,000 gallons of sulfuric acid from the Celanese Fiber Company of Rome, Georgia.

Chattooga River - On November 6, 1961, several thousand dead fish were observed floating down the 6 mile Chattooga River reach above Gaylesville, Alabama. At that time the river was reported to have a dark bluish color and odor resembling dye waste.

On June 13, 1962, another Chattooga River fish kill was investigated and dead fish were again observed at the Henderson Bridge, some 6 miles above Gaylesville, Alabama.

Both of these fish kills in the Chattooga River were attributed to the discharge of pollutional wastes into the upstream reaches of the river.

The Alabama Water Improvement Commission has established minimum standards, including a minimum dissolved oxygen concentration of 4.0 mg/l, for the protection of the Coosa River flowing into the State of Alabama.

SCOPE OF THE 1962 SURVEY

PURPOSE

During August 1962 the Pollution Evaluation Section of the Public Health Service and other cooperating agencies conducted field surveys to determine whether pollution entering the waters in the State of Georgia endangers the health or welfare of persons in the State of Alabama, and constitutes interstate pollution. This interstate concept governed program planning, the location of sampling stations, and the geographical limit of areas to be included in this field survey and report. These studies covered most of the main stem reaches, but did not extend into the uppermost headwaters of the entire river system.

Other waste discharges, contributing to intrastate pollution and currently under investigation by the Georgia State Department of Health, enter the watershed beyond the upstream limits of the August survey. The net pollutional strength of these wastes, however, is materially reduced during the time of travel to the state line. Preliminary data and engineering judgment indicate that the diminished residual effects of these outlying waste discharges do not contribute significally to pollution of the interstate waters entering Alabama.

AREA

The waterways involved in this interstate pollution evaluation survey are shown on Location Map Figure 1. Sampling station locations are shown on Figure 2 and described in the Location Guide Table No. A-1.

The Chattooga River survey started about 3 miles above Trion, Georgia, and extended across the state line into the waters of Lake Weiss.

The Oostanaula River sampling station, established 1-1/4 miles above the confluence with the Etowah River, is located above all sewage and industrial waste outfalls entering the Oostanaula River from the Rome area.

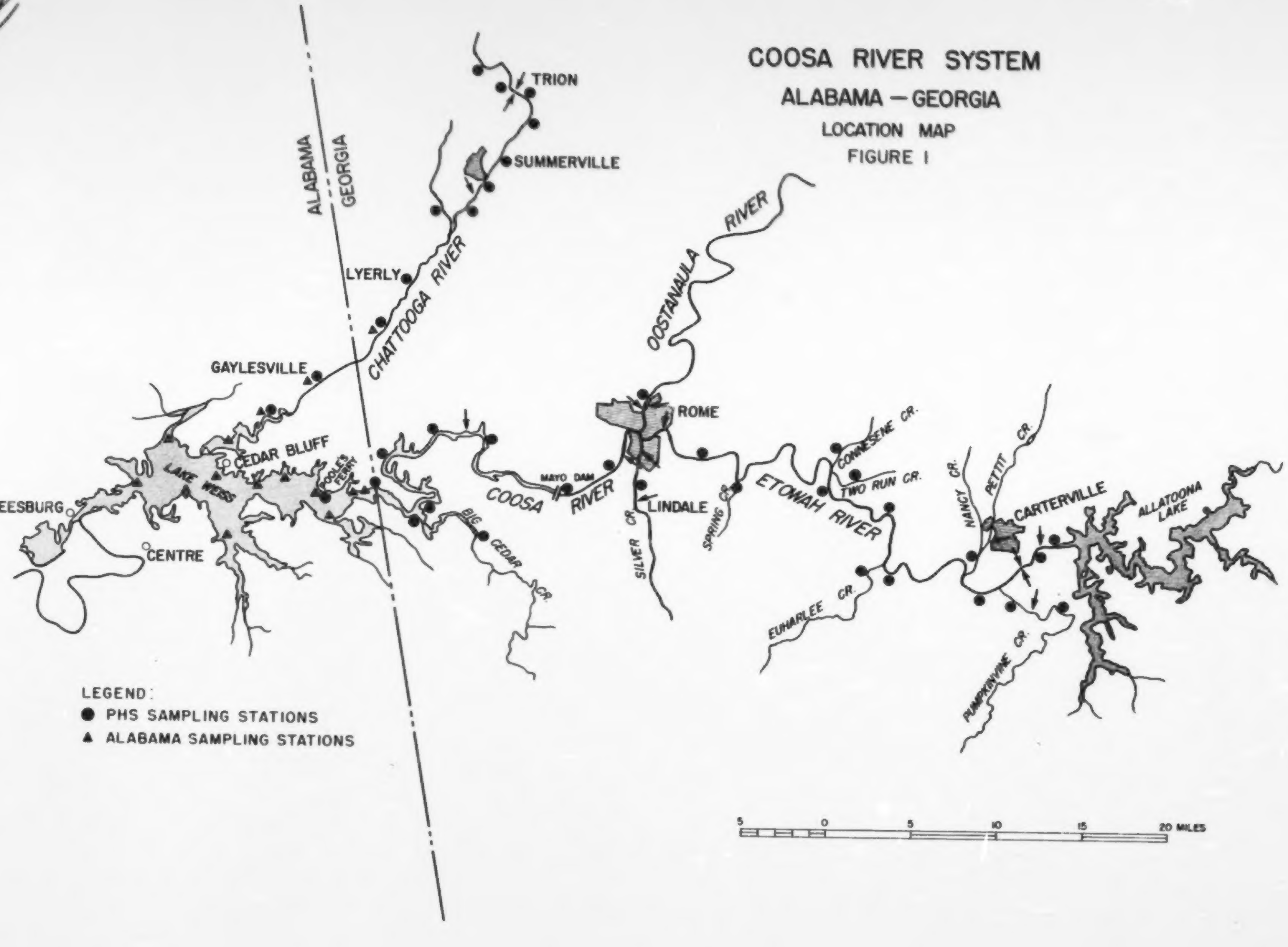
The Etowah River study started at a point immediately below Allatoona Dam near Cartersville, Georgia, and extended downstream to the confluence with the Oostanaula River in Rome, Georgia.

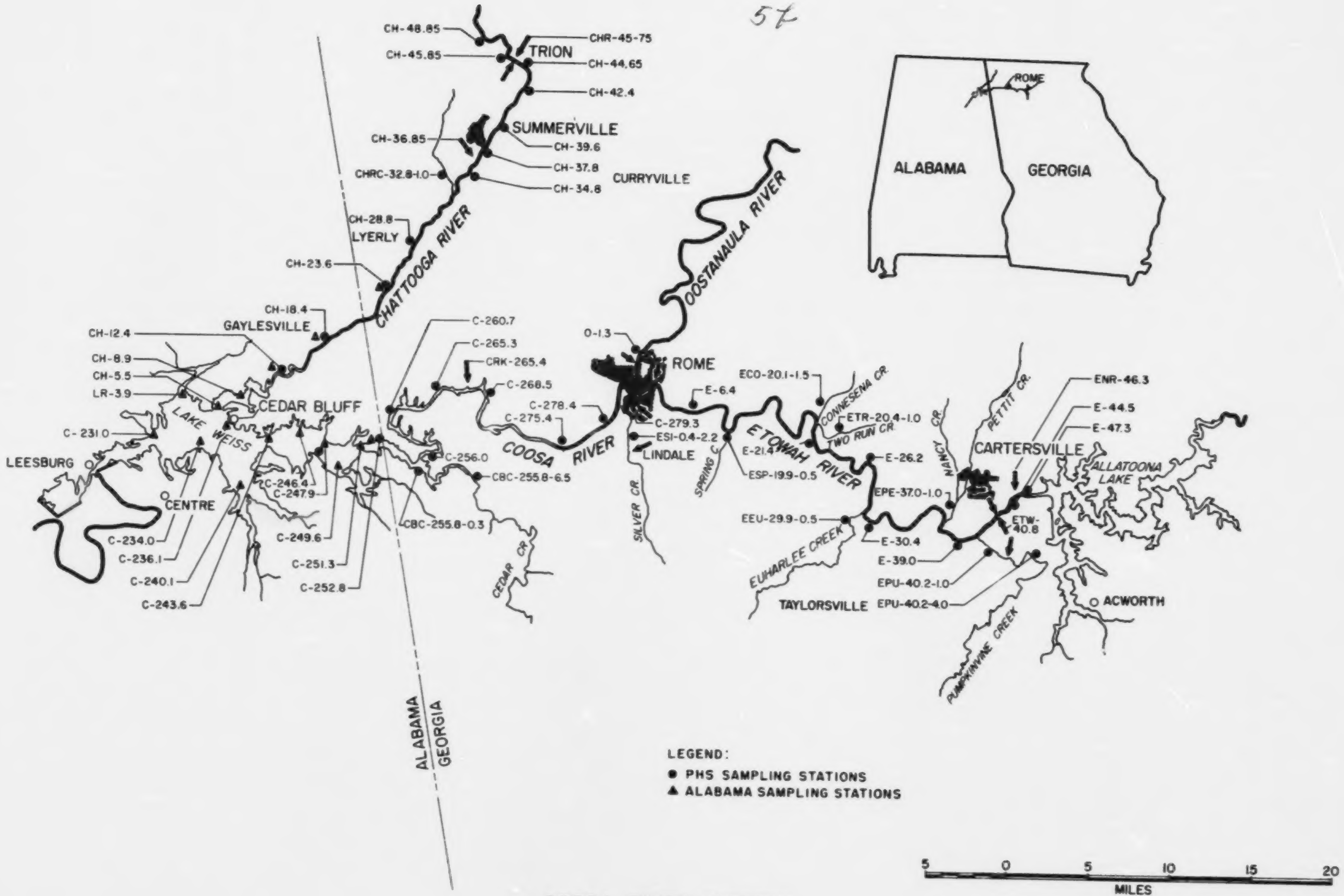
The Coosa River study extended downstream from Rome, Georgia, across the Georgia-Alabama State Line and through Lake Weiss in the State of Alabama.

The Chattooga River above Trion, the Oostanaula River above Rome, the Etowah River above Allatoona Dam, and Cedar Creek in the vicinity of Cedartown were not included in this survey. Preliminary investigations indicated that wastes discharged upstream from these cut-off points exerted no direct damaging effect on the Coosa River waters flowing across the Georgia-Alabama State Line. It is emphasized, however, that omission from this interstate study does not in any way imply that excessive local pollution may not have occurred in some reaches of these streams.

COOSA RIVER SYSTEM
ALABAMA — GEORGIA
LOCATION MAP

FIGURE I


ALABAMA
GEORGIA
TRION
SUMMERVILLE
LYERLY
CHATTOOGA RIVER
GAYLESVILLE
CEDAR BLUFF
LAKE WEISS
POOLES FERRY
LEESBURG
CENTRE
OOSTANAULA RIVER
ROME
COOSA RIVER
MAYO DAM
LINDALE
SILVER CR.
BIG CEDAR CR.
SPRING CR.
CONNESENE CR.
TWO RUN CR.
ETOWAH RIVER
EUHARLEE CR.
NANCY CR.
PETTIT CR.
CARTERVILLE
ALLATOONA LAKE
PUMPKINVINE CR.
LEGEND:
● PHS SAMPLING STATIONS
▲ ALABAMA SAMPLING STATIONS
5
0
5
10
15
20 MILES


CH-48.85
CHR-45-75
TRION
CH-45.85
CH-44.65
CH-42.4
SUMMERVILLE
CH-36.85
CH-39.6
CH-37.8
CURRYVILLE
CHRC-32.8-1.0
CH-34.8
CH-28.8
LYERLY
CHATTOOGA RIVER
CH-23.6
CH-18.4
GAYLESVILLE
CH-12.4
CH-8.9
CH-5.5
LR-3.9
CEDAR BLUFF
LAKE WEISS
C-231.0
LEESBURG
CENTRE
C-234.0
C-236.1
C-240.1
C-243.6
C-246.4
C-247.9
C-249.6
C-251.3
C-252.8
CBC-255.8-0.3
C-256.0
CBC-255.8-6.5
CEDAR CR.
C-260.7
C-265.3
CRK-265.4
C-268.5
C-278.4
C-275.4
COOSA RIVER
O-1.3
ROME
OOSTANAULA RIVER
C-279.3
ESI-0.4-2.2
LINDALE
SILVER CR.
E-6.4
ECO-20.1-1.5
CONNESENA CR.
ETR-20.4-1.0
TWO RUN CR.
E-21.4
SPRING C.
ESP-19.9-0.5
ETOWAH RIVER
E-26.2
EEU-29.9-0.5
EUHARLEE CREEK
TAYLORSVILLE
E-30.4
E-39.0
EPE-37.0-1.0
EPU-40.2-1.0
EPU-40.2-4.0
NANCY CR.
PETTIT CR.
CARTERSVILLE
ENR-46.3
E-44.5
E-47.3
ETW-40.8
ALLATOONA LAKE
PUMPKINVINE CREEK
ACWORTH
ALABAMA
GEORGIA
ROME
ALABAMA
GEORGIA
LEGEND:
● PHS SAMPLING STATIONS
▲ ALABAMA SAMPLING STATIONS
5
0
5
10
15
20
MILES

COOSA RIVER SYSTEM
ALABAMA - GEORGIA
SAMPLING STATION IDENTIFICATION MAP
FIGURE 2

SOURCES OF DATA

The August 1962 field survey data included in this report were collected by two participating field parties. The Public Health Service of the U. S. Department of Health, Education, and Welfare conducted stream surveys on the Chattooga, Coosa, Oostanaula and Etowah Rivers in the State of Georgia. On the Chattooga and Coosa Rivers, these studies extended downstream, across the state line and into the State of Alabama. A field study team from the Alabama State Water Improvement Commission conducted field investigations of Lake Weiss, and the lower reaches of the Chattooga River and the Coosa River impoundment. In the immediate vicinity of the Georgia-Alabama State Line certain sampling station locations were used by both field survey groups.

Georgia State Game and Fish Commission representatives participated actively in the field studies. Biologists and wildlife rangers joined the field survey group and provided most valuable assistance during the biological surveys and the special round-the-clock studies of the Etowah and Coosa Rivers.

During August, and also earlier in the year, the Georgia State Department of Public Health conducted independent stream surveys throughout the entire Coosa River watershed. Although the Georgia State Department of Public Health was unable to participate directly in the Public Health Service-Alabama Water Improvement Commission joint survey, they provided data gathered during their surveys, presented background information, and cooperated in planning and briefing conferences in the Georgia State office.

The Georgia and Alabama Districts of the U. S. Department of the Interior Geological Survey provided provisional river discharge data for the streams under study.

The U. S. Army Engineer District, Mobile, furnished provisional stream discharge data, operating reports on the Allatoona Hydro Plant, and special suspended sediment data for the Etowah River area.

Precipitation records were provided by the Georgia State Climatologist for the U. S. Department of Commerce Weather Bureau in Athens, Georgia.

Representatives of the U. S. Department of Agriculture furnished much valuable background data for the suspended sediment load studies. Soil erosion information was provided by the Southern Piedmont Soil Conservation field station in Watkinsville, Georgia. Estimated sediment rates and soil loss to the streams were provided by the Georgia State Conservationist in Athens, Georgia. The research group of the Coosa Watershed Project in Cartersville, Georgia furnished basic information on erosion from highway road banks.

Rome Kraft Company representatives provided paper mill production, industrial waste discharge and stream survey data collected by their personnel.

Rome, Georgia city officials provided a site for location of the field laboratories and contributed a series of long-term daily turbidity records for the Oostanaula and Etowah Rivers in Rome, Georgia.

FIELD STUDIES

During most of the first 3 weeks in August, routine samples were collected once daily from all sampling stations. A special series of round-the-clock studies were conducted on the Etowah and the Coosa Rivers during the last week in August.

During the initial general survey, samples were analyzed for B.O.D., temperature, D.O., pH, coliform bacteria, turbidity, color, and suspended solids. A biological survey of these waters included studies on bottom dwelling organisms, plankton, attached algae and slimes, and measurements of light penetration and silt deposition.

Samples were collected at more frequent intervals throughout each 24-hour cycle of the special round-the-clock studies. The sampling intervals ranged from every half hour near Cartersville, Georgia, to every 4 hours near the state line. Samples were analyzed for turbidity and suspended solids. B.O.D. and D.O. determinations were also run on selected groups of samples.

WATER USES

The rivers and lakes in the study area are used principally to generate hydroelectric power, serve as a source of industrial and domestic water supply, and provide water sport recreational facilities.

HYDROELECTRIC POWER

Two hydroelectric power dams have been constructed on this watershed. The U. S. Corps of Engineers' Allatoona Power Dam on the Etowah River is located near Cartersville, Georgia. The Alabama Power Company Weiss Power Dam on the Coosa River is located near Centre, Alabama.

WATER SUPPLY

The extent to which these rivers are used as sources for industrial and domestic water supply is shown in the following tabulation of principal existing water supplies:

Industrial		mgd	
Etowah River	New Riverside Ochre Company	0.5	Untreated
Etowah River	Thompson Weinman Company	1.0	Untreated
Oostanaula River	Celanese Corporation	7.0	Treated
Coosa River	Rome Kraft Company	18.0	Treated

Domestic		mgd	
Etowah River	Cartersville, Georgia	2.5	Treated
Oostanaula River	Rome, Georgia	5.0	Treated
Coosa River	Cedar Bluff, Alabama	0.05	Treated
Coosa River	Gadsden, Alabama	10.0	Treated

RECREATION

Construction of the Alabama Power Company Dam across the Coosa River near Centre, Alabama, in 1961 created the Lake Weiss impoundment. This reservoir covers some 31,000 acres and includes approximately 440 miles of shore line. It has been estimated that more than 10 per cent of the entire shore line is suitable for residential and summer home development. More than 100 homes, costing an estimated 800,000 dollars, were built on the shores of this lake during the first year and about 200 additional lots were acquired for access to and enjoyment of the lake. It is reported that 1 acre lots, fronting on the deep clear water portions of Lake Weiss, sell for approximately 2,500 dollars per lot, and that similar size lots abutting deep water in cove areas are selling for about 1,200 dollars per lot.

The Chattooga and Coosa River waters of Lake Weiss are used for swimming, fishing, boating, water skiing and other water contact sports. It is expected that the recreational use of these waters will expand at an accelerated pace as more and more lake shore property is developed and more access areas are provided.

PRINCIPAL WASTE DISCHARGES

The principal sewage and industrial waste discharges into the reaches of the Coosa River System under consideration are listed on Table No. 1.

The pollutional strength of these wastes is expressed in population equivalents, or P.E., which permits expression of both domestic sewage and organic industrial waste loadings in common units. An industrial waste with 1,000 population equivalents, for example, would have approximately the same organic pollutional strength as the raw sewage discharged from a sewered community of 1,000 persons. Similarly, a 1,000 B.P.E., or bacterial population equivalent, represents the number of coliform bacteria that would normally be present in a stream polluted by sewage from a community with a sewered population of 1,000.

CHATTOOGA RIVER

Approximately 89 per cent of the organic waste loading to the reach of the Chattooga River involved was discharged from the Riegel Textile Mill in Trion, Georgia. This mill produces approximately

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COOSA RIVER SYSTEM - GEORGIA-ALABAMA

ESTIMATED WASTE DISCHARGES

TABLE NO. 1

CHATTOOGA RIVER

3 YRS

Trion, Georgia	3,000 P.E.	Raw Sewage
Riegel Textile Company	112,000 P.E.	Process Waste
Summerville, Georgia	3,200 P.E.	Raw Sewage
Montgomery Knitting Company	400 P.E.	
Summerville Manufacturing Company	600 P.E.	
Georgia Rug Mill	6,000 P.E.	
Berryton, Georgia	-	
Harriett & Henderson Cotton Mills	35 P.E.	

1966

ETOWAH RIVER

New Riverside Ochre Company	500 tons of Mineral Washings per Day
Thompson Weinman Company	0.14 tons of Mineral Washings per Day

COOSA RIVER

Waiting for report in next week - Construction in 1961

Rome, Georgia	40,000 P.E.	Raw Sewage
Celanese Fiber Company	Undetermined	amt. to Oostanaula River
Textile & Misc. Industries	Undetermined	amt. to City Sewers
Rome Kraft Company	243,000 P.E.	Treated paper mill waste to Coosa River

New plant - Last Thursday - Early 1964

SILVER CREEK

Lindale, Georgia	350 P.E.	Effluent from complete treatment plant
Pepperell Manufacturing Company	5,000 P.E.	Of textile waste

800,000 pounds per week of cotton fabrics from baled cotton and includes desizing, bleaching, dyeing, printing and finishing operations. Untreated process wastes from this mill with an estimated 112,000 population equivalent were discharged into a small creek leading directly to the Chattooga River. Raw sewage from the City of Trion, with an estimated 3,000 P.E., also entered this reach of the river.

Raw sewage from the City of Summerville, Georgia, with a population equivalent of approximately 3,200 was discharged directly to the Chattooga River. Industrial wastes and, or, sanitary sewage from the Montgomery Knitting Company, Summerville Manufacturing Company, and the Georgia Rug Mill were discharged to the river through the Summerville sanitary sewers. The Georgia Rug Mill, with an estimated P.E. of 6,000, produces about 100,000 square yards of tufted rugs per week from nylon and cotton yarns and part of the production is piece dyed. The Montgomery Knitting Company produces knitted hosiery. The Summerville Manufacturing Company produces cotton duck.

ETOWAH RIVER

Process wastes from mineral, chemical and textile industries and raw domestic sewage from the municipality were discharged to the Etowah River in the vicinity of Cartersville, Georgia. During the August survey, silt from the mining operations were carried downstream into the Coosa River and across the Georgia-Alabama State Line. The effects of organic and bacterial pollution from the Cartersville area were local rather than interstate.

The New Riverside Ochre Company produces about 300 tons of barites per day and 200 tons of ochre per month. Crude ores, trucked from nearby open pit mines, are subjected to ore dressing, washing and floatation operations necessary to recover the commercial product. Mineral washing wastes containing about 500 tons of solids per day are discharged to the Etowah River above Cartersville.

The Thompson Weinman Company produces about 300 tons of barites per day from a matrix of rock, clay and sand obtained from adjacent open pit mines. Wastes from the ore washing operations flow to three large holding ponds covering some 160 acres. Only 0.14 tons of solids per day were discharged from those ponds to the Etowah River during the August 1962 survey.

Two mineral ore washing and classifying plants, one owned by Mosteller Brothers and the other by R. T. Haney and Horace McMicken, are located on the banks of Pumpkinvine Creek south of Cartersville. Wash waters from both plants are normally discharged to a common holding pond. During the August survey these plants were not in full operation, and there were no discharges to Pumpkinvine Creek.

Silver Creek enters the Etowah River in Rome at River Mile E-0.4. All domestic sewage from the Village of Lindale, located at the headwaters of this creek, received complete sewage treatment before discharge into the creek. The strength of this treated sewage is estimated at approximately 350 P.E.

The Pepperell Manufacturing Company of Lindale produces over 20,000,000 pounds of gray goods per year from baled cotton and a small amount of rayon and nylon. Less than half of the production involves wet processes. Yarns are dyed before weaving. Sanitary wastes entered the municipal sewer and an estimated 5,000 P.E. of process wastes were discharged to Silver Creek.

Raw sewage and some industrial waste from Rome also entered Silver Creek and the Etowah River.

OOSTANAULA RIVER

The Celanese Fibers Company plant in Rome produces approximately 16,000,000 pounds of viscose rayon yarn per year from wood pulp, caustic soda and carbon disulfide, and 7,500,000 pounds of cellulose acetate yarn per year from cellulose acetate flake and acetone. Sanitary wastes are treated in septic tanks and discharged to the municipal sewer. Bobbin washing wastes are discharged to a natural lagoon which drains to the Oostanaula River through Burrell Creek. Other process wastes are discharged to a municipal sewer leading to the Oostanaula River.

COOSA RIVER

Untreated domestic sewage and associated industrial wastes from the Rome Metropolitan Area entered the Coosa, Etowah and Oostanaula Rivers. The estimated raw domestic sewage loading was 40,000 P.E.

The Rome Kraft Company plant, located some 15 miles downstream from Rome, produces approximately 1,300 tons per day of container board from soft and hard woods by the Kraft sulfate process. Sanitary sewage, water treatment sludges, and the waste from ash sluicing are discharged directly to the Coosa River. Overflow from the chip preparation area and waste water from the dry end of the paper machines are discharged to a decanting pond, and the pond effluent is discharged to the river. All other process wastes are treated in a trickling filter and lagoon waste treatment system before discharge to the Coosa River.

During August 1962, the average pollutional strength of this treated waste amounted to 243,000 P.E. This treated waste was the major source of organic pollutional loading to the Coosa River in the study area. The suspended solids loading approximated 15 tons per day. B.O.D. loading and river quality data provided by the Rome Kraft Company are shown in Table No. A-2.

RIVER WATER QUALITY AND DAMAGE TO WATER USE

RIVER WATER QUALITY

Chattooga River

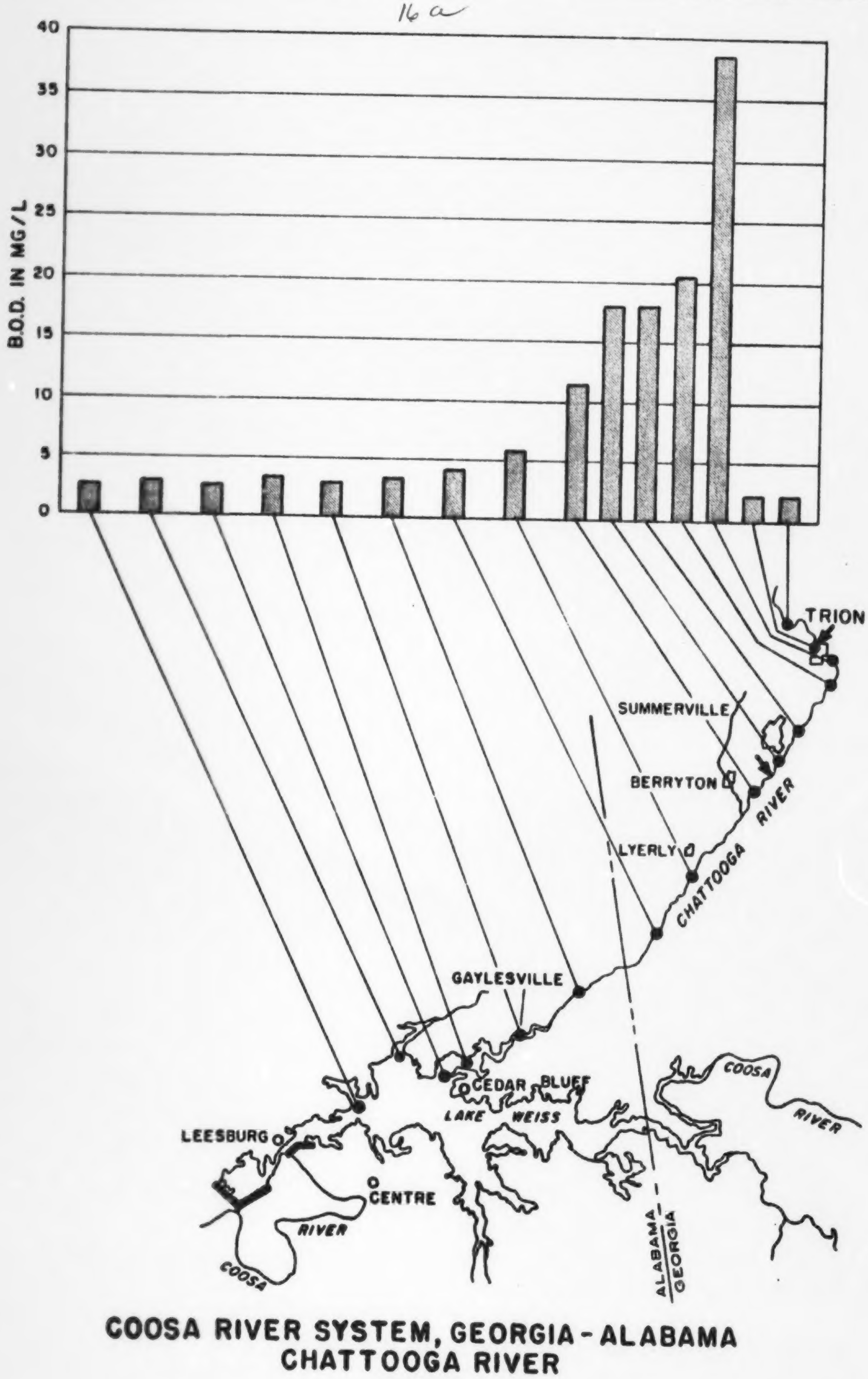
5-Day Biochemical Oxygen Demand (B.O.D.)

The 5-day biochemical oxygen demand, or B.O.D., is a measure of dissolved oxygen that is used by unstable organic matter in water.

The B.O.D. of the Chattooga River waters from above Trion, Georgia, and down into Lake Weiss in the State of Alabama is shown on Figure 3. A summary of the field data, including maximum, minimum, and average B.O.D. values at each sampling station is posted in Tables A-3 and A-4.

In Trion, Georgia, (CH-45.85) above the sewage outfall and about one-tenth of a mile above the Riegel Textile plant waste outfall, the B.O.D. averaged 2.2 mg/l. About 1 mile below Trion (CH-44.65) the average B.O.D. increased to 38.6 and ranged from 30 to 49 mg/l. As shown in the accompanying dissolved oxygen summaries, the large pollutional load, primarily from the Riegel Textile plant, greatly exceeded the pollution assimilation capacity of the Chattooga River and seriously depleted the dissolved oxygen for 21 miles downstream.

16a



COOSA RIVER SYSTEM, GEORGIA - ALABAMA
CHATTOOGA RIVER
B.O.D.
AVERAGE CONCENTRATION - AUGUST, 1962

FIGURE 3

About 1 mile above the Summerville outfall sewer (CH-37.8) the average B.O.D. was reduced to 17.8 mg/l. In the next 3-mile reach, the amount of residual upstream pollution removed by natural purification forces apparently exceeded the amount of fresh pollution discharged from the Summerville outfall sewer. At River Mile CH-34.8, some 2 miles below the Summerville sewer, the B.O.D. was further reduced to 11.6 mg/l. No significant amounts of pollution entered the river below the Summerville outfall. The B.O.D.'s then dropped systematically from 5.8 mg/l at Lyerly to about 2.5 mg/l in Lake Weiss. The damaging effects of the excessively high B.O.D. loadings are discussed in the following dissolved oxygen section of this report.

Dissolved Oxygen (D.O.)

In order to support fish and other beneficial aquatic life, streams must contain dissolved oxygen. It is generally agreed that most game fishes, including bass and bluegills, require at least 4 to 5 mg/l. If the D.O. is suppressed significantly below 4 mg/l the aquatic environment becomes unsuitable for the propagation of many species. At various D.O. levels below 3 mg/l, fish will leave the oxygen deficient areas or die. Obviously, all fishes and most other normal aquatic life will be killed where decomposing organic pollution removes all dissolved oxygen from the stream.

The Alabama State Water Improvement Commission has set a minimum dissolved oxygen requirement of 4 mg/l to protect the fisheries and recreation values of the waters within the State.

The dissolved oxygen content of the Chattooga River is summarized in Table No. 2 and illustrated on Figure 4.

Above Trion (CH-45.85) the Chattooga River waters were almost completely saturated with dissolved oxygen. The D.O. ranged from 8.2 to 9.4 for an average of 8.6 mg/l.

Industrial wastes from the Riegel Textile Corporation in Trion, discharged to the Chattooga River at River Mile CHR-45.75, drastically reduced the dissolved oxygen resources of the Chattooga River. Three miles below this waste discharge, (CH-42.4) the average dissolved oxygen concentration dropped to 2.4 mg/l, and 93 per cent of all samples collected at this station contained less than 4 mg/l of dissolved oxygen.

Eight miles below this waste discharge and 1 mile above the Summerville outfall sewer, the dissolved oxygen averaged 1 mg/l. At this station (CH-37.8) over half, or 57 per cent of all samples collected were completely devoid of dissolved oxygen. Eighty-five per cent of the samples contained less than 4.0 mg/l. This severe oxygen deficit was caused almost entirely by process wastes from the Riegel Textile Corporation.

Two miles below the Summerville outfall sewer (CH-34.8) the dissolved oxygen concentration increased slightly to 1.3 mg/l, but 57 per cent of the samples were completely devoid of dissolved oxygen and 85 per cent contained less than 4.0 mg/l. The only samples showing significant quantities of dissolved oxygen were collected on Sunday or early on Monday mornings before the normal weekday industrial waste discharges from the Trion area reached this section of the stream.

18a

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

DISSOLVED OXYGEN SUMMARY

TABLE NO. 2

CHATTOOGA RIVER

STATION NO.	RIVER MILE	NO. OF SAMPLES	SURVEYS INCLUDED	D.O. (mg/1) MAX.	MIN.	AVG.	% Below 4.0 mg/1	% of 0.0 mg/1
CH-9	CH-48.85	14	G	8.3	5.3	6.6	0	0
CH-8 B	CH-45.85	9	G	9.4	8.2	8.6	0	0
CH-8 A	CH-44.65	4	G	6.7	4.0	4.9	0	0
CH-8	CH-42.4	14	G	5.2	1.5	2.4	93%	0
CH-7	CH-39.6	14	G	5.9	0.0	1.1	85%	21%
CH-6	CH-37.8	14	G	6.0	0.0	1.0	85%	57%
CH-5	CH-34.8	14	G	6.7	0.0	1.3	85%	57%
CH-4	CH-28.8	14	G	6.3	0.7	3.2	57%	0
CH-3/1-C	CH-23.6	34	G + A	7.8	1.7	3.9	56%	0
CH-2/2-CH	CH-18.4	34	G + A	8.2	3.1	4.6	29%	0
CH-1/3-CH	CH-12.4	34	G + A	9.1	2.1	4.5	56%	0
4-CH	CH- 8.9	20	A	9.5	2.3	7.0	5%	0
5-CH	CH- 5.5	15	A	9.9	5.7	7.3	0	0
1-LR	-	15	A	10.0	6.4	7.9	0	0
10-C	C-231.0	15	A	9.7	5.6	7.6	0	0

G = PHS GENERAL SURVEY

A - ALABAMA SURVEY

18f

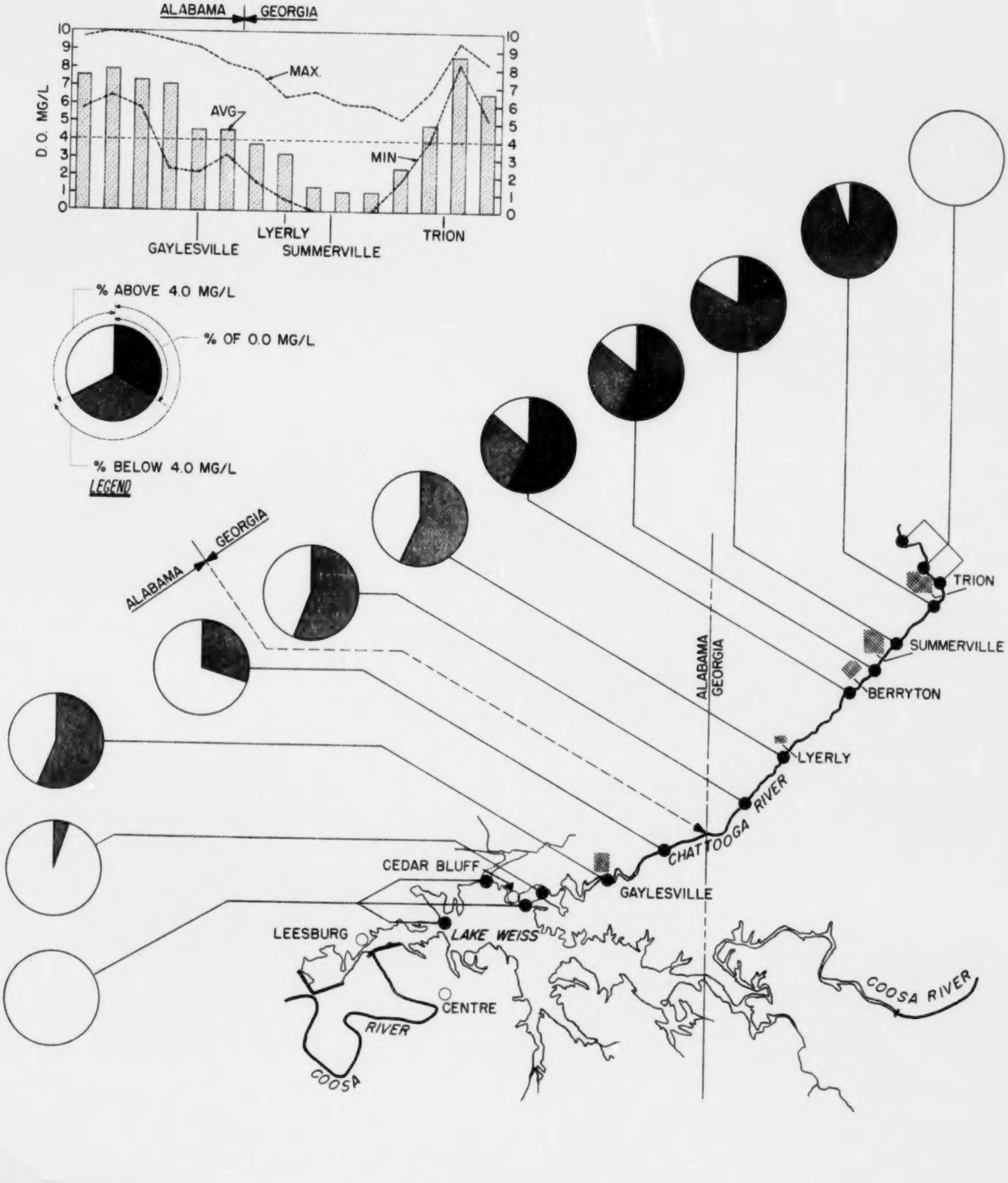
COOSA RIVER SYSTEM, GEORGIA - ALABAMA

CHATTOOGA RIVER

DISSOLVED OXYGEN

PERCENT OF SAMPLES BELOW 4.0 MG/L - AUGUST 1962

FIGURE 4



ALABAMA
GEORGIA
D.O. MG/L
0
1
2
3
4
5
6
7
8
9
10
MAX.
AVG.
MIN.
GAYLESVILLE
LYERLY
SUMMERVILLE
TRION
% ABOVE 4.0 MG/L
% OF 0.0 MG/L
% BELOW 4.0 MG/L
LEGEND
ALABAMA
GEORGIA
TRION
SUMMERVILLE
BERRYTON
LYERLY
CHATTOOGA RIVER
GAYLESVILLE
CEDAR BLUFF
LEESBURG
LAKE WEISS
CENTRE
COOSA RIVER
COOSA RIVER

Downstream from Lyerly the stream began to recover but remained in critical condition at the state line.

Two miles above the Georgia-Alabama State Line the dissolved oxygen content averaged 3.8 mg/l, but more than half of the samples contained less than 4.0 mg/l. Beyond this point the average oxygen content improved, but at Gaylesville, Alabama, some 9 miles below the state line, more than 50 per cent of the samples contained less than 4 mg/l of dissolved oxygen.

About 15 miles below the state line, in the Chattooga arm of Lake Weiss, the average dissolved oxygen content increased to a satisfactory level of 7 mg/l, although 1 sample contained less than the 4.0 mg/l minimum. Farther down in Lake Weiss proper the averages ranged from 7 to almost 8 mg/l and no samples contained less than 5.6 mg/l of dissolved oxygen.

The dissolved oxygen data and the previously discussed B.O.D. results show that the Chattooga River is grossly polluted by sewage and industrial wastes. The most severe effects occurred in the vicinity of Summerville, Georgia. The decomposing organic materials reduced the dissolved oxygen below the survival level for fish and aquatic life. Although stream recovery started around Lyerly, Georgia, the quality of the interstate waters passing the Georgia-Alabama State Line remained critical. More than one-half of the samples collected 1 mile above the state line and 9 miles below the state line at Gaylesville, Alabama, contained less than the 4 mg/l minimum dissolved oxygen requirement.

Hydrogen Ion Concentration (pH)

The hydrogen ion concentration, or pH, indicates the degree of acidity or alkalinity of the waters. Fish and other aquatic life can tolerate moderately acid and alkaline waters in the pH range from about 5.4 to 8.5. The range and average pH of the Chattooga River waters are posted on Tables A-3 and A-4.

The pH of the river entering Trion, Georgia, averaged 7.2. Alkaline wastes from the Riegel Textile plant increased the average pH to 9.7 at the Highway No. 27 bridge 1 mile below Trion. The pH averaged 9.0 at the first station below Summerville and 8.0 in Lake Weiss.

The alkaline wastes increased the pH of the river between Trion and the Summerville area to levels that can destroy or seriously inhibit aquatic life. The pH values of waters flowing across the state line and through Lake Weiss were satisfactory.

Color and Physical Appearance

The color of the Chattooga River, determined according to Standard Methods for the Examination of Water and Sewage, is also shown in Table A-3.

Chattooga River water entering the Trion area contained 11 color units. One mile below the Riegel Textile Mill waste discharge the color intensity rose to 57 color units. Three miles below Trion the color averaged 33 color units and remained at approximately this level down to the first station above Summerville. From this point on downstream the average color intensity decreased at a substantially uniform rate to 19 color units just above the state line and between 16 and 15 units at the last 2 stations in Alabama below the state line.

When river waters are polluted by dyes or similar wastes containing a variety of unnatural hues and colors, visual observations of the stream proper can be more informative and provide a more realistic picture of the actual stream appearance than routine comparison with the laboratory color intensity standards. The color of the Chattooga River water below Trion changed from day to day according to the type, volume and intensity of dye stuffs included in the textile mill waste discharge. At times the river was deep blue, almost black. At other times it presented a dirty gray appearance, and on 1 occasion the river turned brilliant green. The colors faded perceptively in the downstream reaches from below Summerville to the state line. A variety of colors, mostly grays and greens, but much less intense than those observed upstream, were at times present near the state line. At the Highway 35 bridge at Gaylesville, Alabama, the waters were generally much greener than above the state line. The green color at this station, however, was caused by algae growths in this embayment of Lake Weiss.

In summary, pollution by textile mill wastes has degraded the appearance of the Chattooga River and has made many sections of the stream unattractive for scenic or recreational use.

Coliform Bacterial Density (MPN/100 ml)

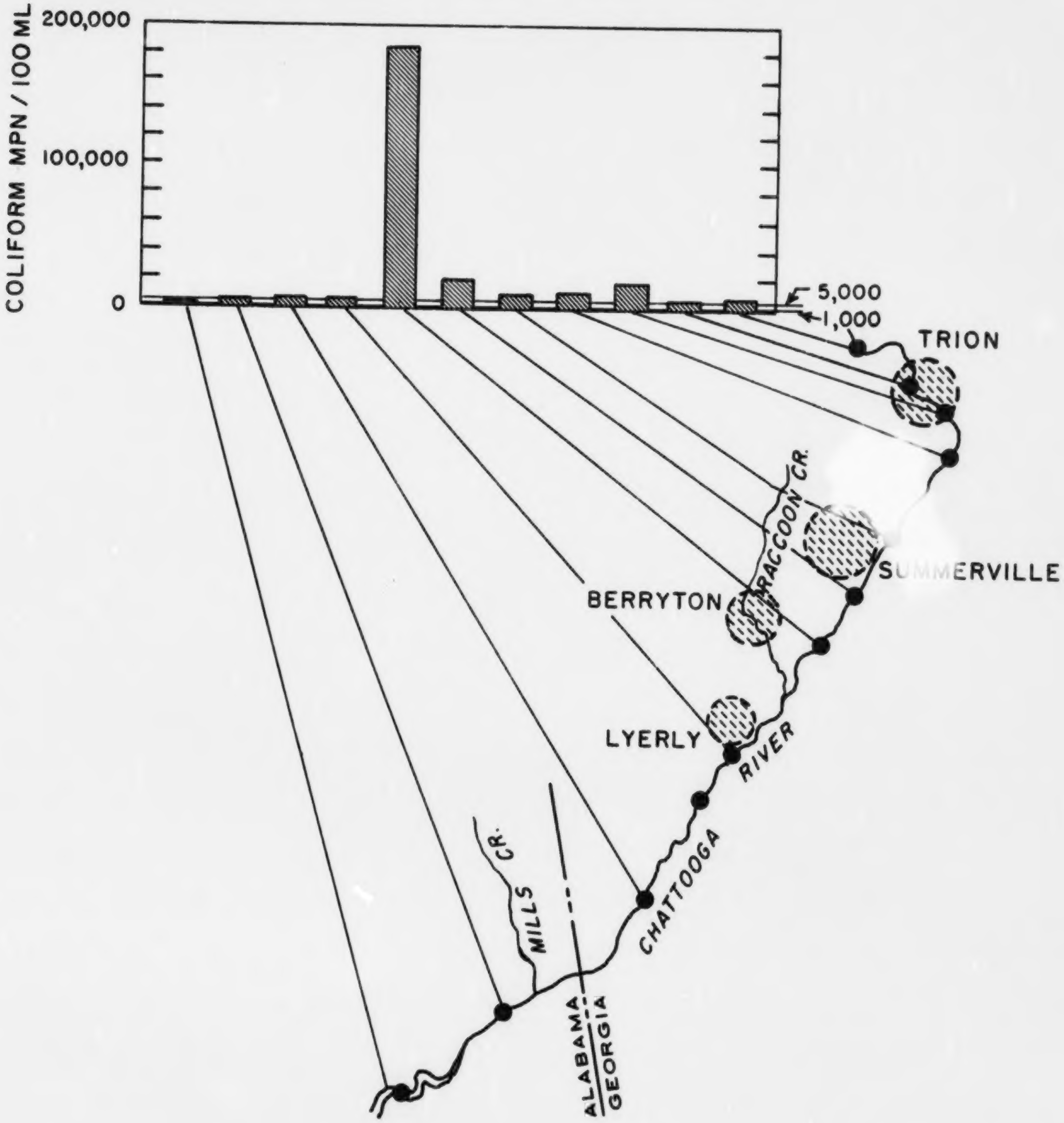
The most probable numbers of coliform bacteria per 100 ml of sample, found at the Chattooga River sampling stations are posted in Table No. A-3 and shown on Figure 5. The coliform bacterial density generally indicates the extent to which waters are contaminated by domestic sewage. It is commonly accepted that river water used as a source of domestic water supply should contain less than 5,000 coliform bacteria per 100 ml before treatment. For swimming and other water contact sports, a commonly accepted upper limit is 1,000 per 100 ml.

The coliform density of Chattooga River waters entering Trion averaged 5,000 MPN/100 ml. One mile below the Trion raw sewage discharge, the concentration increased to 19,000 per 100 ml. The averages ranged from 9,000 to 20,000 down to Summerville, Georgia. Two miles below the Summerville sewer outfall the average increased to 185,000 MPN/100 ml. The averages then decreased to 7,400 two miles above the state line and 6,000 three miles below the state line. At Gaylesville, Alabama, some 9 miles below the state line, the coliform density averaged 1,800 MPN per 100 ml.

Sewage from Trion and Summerville, Georgia, contaminating the Chattooga River down across the state line and into the State of Alabama, increased the coliform content above the maximum levels considered satisfactory for water contact sports.

The coliform bacterial densities probably would have been much greater if the Riegel Textile wastes had not exerted a toxic effect. The bacterial growth-inhibiting effect of Riegel Textile wastes is shown in the following tabulation of special toxicity tests run during the August survey.

23a



COOSA RIVER SYSTEM, GEORGIA - ALABAMA
CHATTOOGA RIVER
COLIFORM BACTERIA
MPN / 100 ML - AUGUST 1962

FIGURE 5

River Mile CH-45.85	Moderately growth inhibiting.
Riegel Wastes	Very growth inhibiting.
River Mile CH-42.4	Growth inhibiting.
River Mile CH-34.8	Growth inhibiting.
River Mile CH-18.4	Moderately growth inhibiting.

Calculations based on average coliform MPN for raw domestic sewage indicate that raw sewage from a 3,000 population community discharged into a stream flowing at approximately 100 cfs, would normally increase the coliform content of the stream to about 500,000 per 100 ml. Thus, the coliform content would normally be expected to approach 500,000 per 100 ml below Trion if the growth-inhibiting substances were not discharged to the stream. Below the Summerville sanitary sewer, the additional coliform load would raise the total MPN significantly above this 500,000 level. Assuming normal decrease due to natural purification, the residual coliform density would probably be 100,000 or more in the vicinity of the state line. These calculations reveal that the potential danger from the Trion and Summerville raw sewage contamination is much greater than indicated by the measured coliform densities. Provision of adequate municipal sewage treatment facilities is the proper method for controlling public health hazards of this type.

The reduction of coliform bacteria by the Riegel Textile wastes was, in itself, beneficial. Unfortunately, the toxic effects of these wastes were not specifically limited to the destruction of coliform and associated harmful bacteria. These wastes also killed desirable aquatic species and posed a constant threat to fish life in the Chattooga River.

Biological Studies

Clean waters support a wide variety of benthos or bottom dwelling organisms which are exacting in their habitat requirements. Their production may be controlled by several aquatic factors, including dissolved salts, the speed of the current, water temperature, dissolved oxygen, the physical nature of the stream bed, and the frequency and magnitude of flooding. Physical stream conditions, such as changed in stream bottom caused by the deposition of silt or sludge and other particulate matter over the rubble affect quantitative and qualitative distribution of the benthos. The diversity of biota normally decreases as the stream bed changes from rubble through gravel, gravel and sand, and muck and pure sand, as the number and variety of utilizable living spaces decrease. For example, the relative productivity of a rubble bottom may be 50 times greater than pure sand. Thus, the type of substrate is an important factor in the development of a benthic society.

Bottom dwelling organisms are directly subjected to any substance which may enter the environment. Typically excessive organic wastes will produce drastic changes within the benthic community. If organic pollution becomes severe there is an immediate reduction in both the species and the total population of organisms. A short distance downstream the number of species remains low because only tolerant forms can withstand conditions within the bottom substrate, and the total population increases because of a rich and constant food supply (i.e. organic wastes) and a marked decrease in predation within the biotic community.

Gradually at some point downstream the number of species builds up to a normal level and the population gradually decreases because natural purification reduces the organic wastes which serve as food.

Severely toxic wastes will eliminate all benthic organisms from a given environment. Moderately toxic wastes, on the other hand, will eliminate those organisms most susceptible to the substance.

The bottom dwelling biota observed on the Chattooga River from above Trion, Georgia, to Gaylesville, Alabama, during the August 1962 survey is illustrated in Figure 6. Throughout the stretch of river studied, the bottom substrate was composed of rock and coarse gravel with occasionally intermingled sand. Occasionally, organic sludge or attached algae covered the bottom substrate.

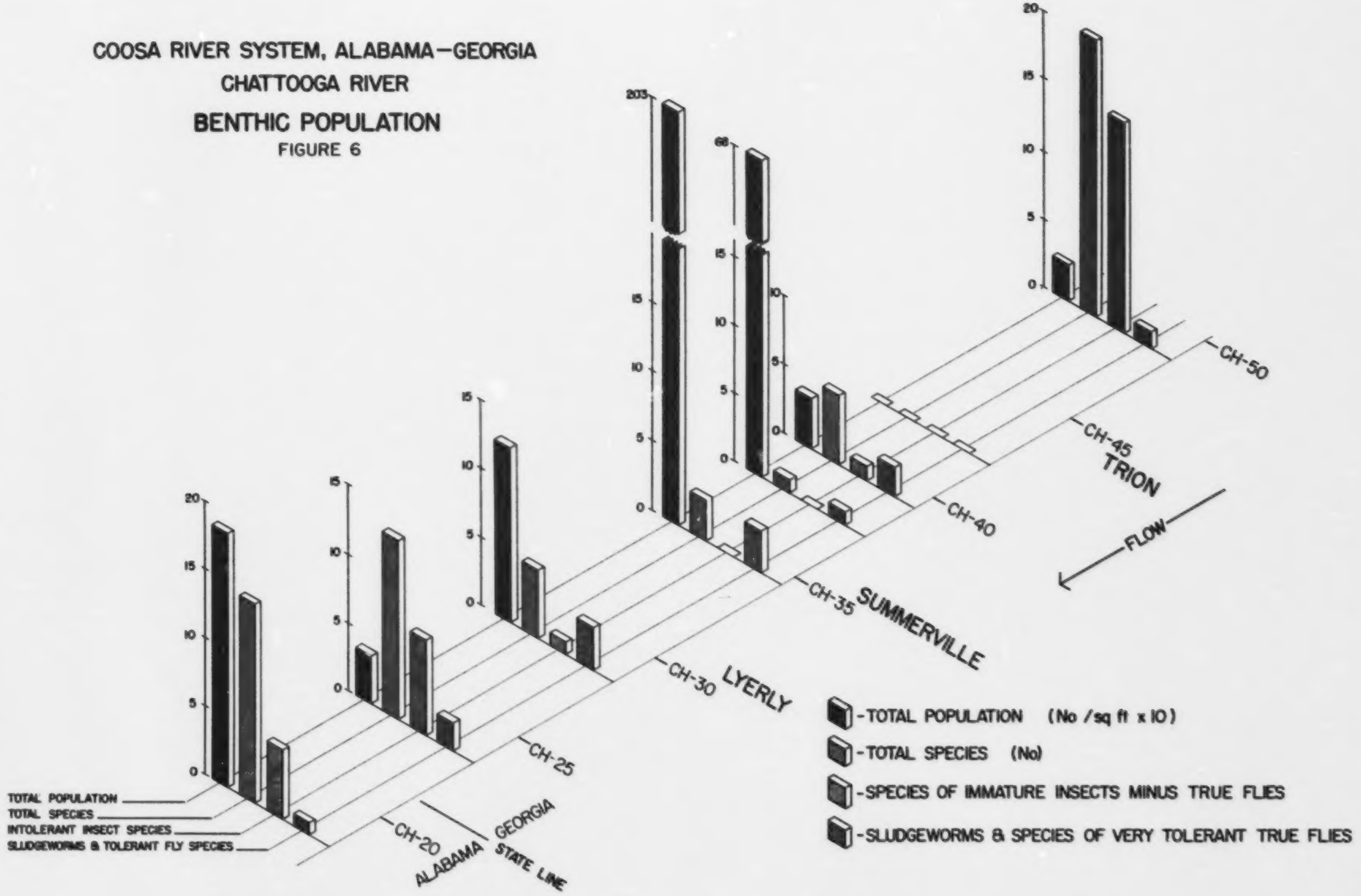
Above Trion, Georgia, the benthic community consisted of a large number of different kinds of organisms, predominately immature insects intolerant of pollution.

Three miles below Trion no bottom dwelling organisms of any kind were found. There was only a layer of black sludge covering the bottom of the stream bed. This sludge represents the settlings from the sewage and industrial wastes entering the river at Trion. The absence of bottom dwelling organisms confirms the bacterial toxicity studies discussed earlier and indicates that the upstream wastes, particularly the textile waste discharges, are toxic or poisonous to the biota in this stream reach.

Three miles downstream, stream bottom conditions were only slightly improved. The settled sludge layer was less than 1 inch thick. Tolerant

COOSA RIVER SYSTEM, ALABAMA—GEORGIA
CHATTOOGA RIVER
BENTHIC POPULATION

FIGURE 6



and very tolerant biota predominated. A tolerant green alga was noted adhering to the bottom deposits. Two miles farther downstream the green alga was still evident; filamentous blue-green algae and diatoms were attached to the rocks. The sludgeworm population, the only benthic organisms encountered, reached a density of 680 per square foot.

The series of observations at River Mile 34.8, some 2 miles below Summerville, shows the total effect of the residual wastes from the Trion area and the fresh raw sewage and industrial wastes from the Summerville outfall sewer. As shown on Figure 6, the total bottom organism population increased to more than 2,000 per square foot. Only those organisms which can survive in polluted waters were found at this sampling station; sludgeworms predominated. These were found in the 2-inch layer of organic sludge which covered most of the bottom deposits. The absence of clean water species, the manner in which the river bottom was taken over by sludgeworms and other tolerant species, along with the frequent complete absence of dissolved oxygen, shows how grossly this region of the stream was polluted.

Below Lyerly, sludge was not apparent, but the majority of organisms were sludgeworms and tolerant midge larvae. A reduction in population numbers and an increase in numbers of species at this point, however, indicated the start of stream recovery.

Two miles above the Georgia-Alabama line and 3 miles below the state line, a normal population of benthic forms was encountered. Immature insects associated with clean water were not as prevalent as above Trion, but did make up approximately half of the total species encountered at the respective stations.

Etowah, Oostanaula and Coosa Rivers

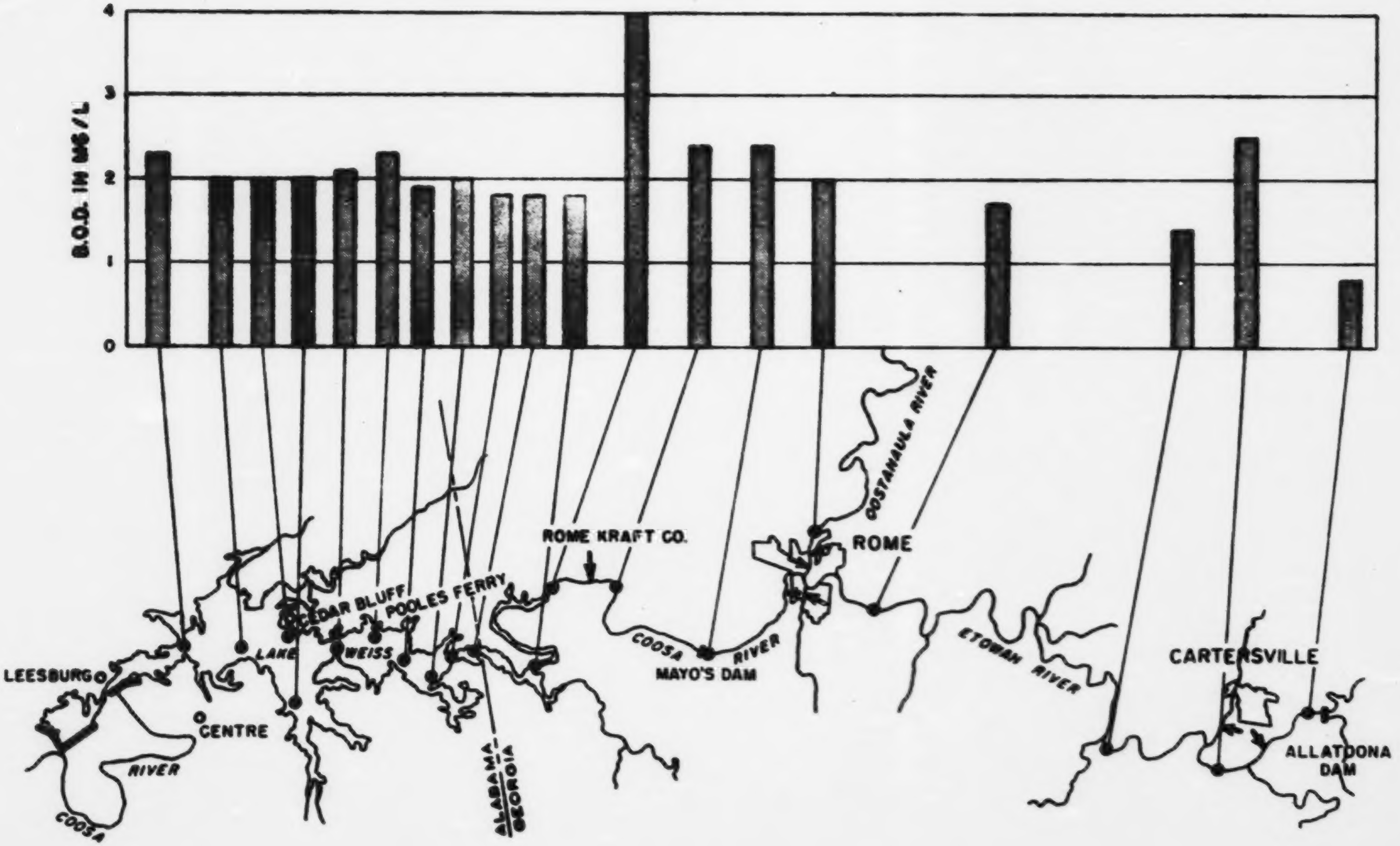
5-Day Biochemical Oxygen Demand (B.O.D.)

A summary of the August general survey data, including B.O.D. is posted on Tables No. A-5, A-6, and A-7. Figure No. 7 shows the average B.O.D.'s from Cartersville to Lake Weiss. The B.O.D.'s collected during the special round-the-clock survey were used to develop the Etowah River section of Figure 7.

Waters discharged through Allatoona Dam contained 0.8 mg/l of B.O.D. At Station E-39.0, below the Cartersville Etowah River sewer outfall but above Pettit Creek, the average B.O.D. increased to 2.5 mg/l. At Station E-30.4, some 7 miles below Pettit Creek, the B.O.D. was reduced to 1.4. At River Mile E-6.4 near the mouth of the Etowah, the B.O.D. averaged 1.7 mg/l.

Immediately above Rome at River Mile O-1.3, the Oostanaula River water B.O.D. averaged 2.0 mg/l. The calculated average B.O.D. of the combined Etowah and Oostanaula River waters at the confluence was approximately 1.8 mg/l.

The average B.O.D. of the Coosa increased to 2.4 mg/l below Rome. The average B.O.D. remained at this 2.4 mg/l level down to Station C-268.5, approximately 15 miles below Rome and 1 mile above the Rome Kraft industrial waste outfall diffuser.



COOSA RIVER SYSTEM, GEORGIA-ALABAMA
ETOWAH, OOSTANAULA AND COOSA RIVERS
B.O.D.
AVERAGE CONCENTRATION-AUGUST, 1962

FIGURE 7

Two miles below the industrial waste diffuser the B.O.D. increased to 4.0 mg/l. Nine miles downstream the residual B.O.D. was reduced to 1.8 mg/l, and remained at this level as it crossed the Georgia-Alabama State Line. Except for 2 stations where the B.O.D. averaged 2.3 mg/l, the B.O.D. remained at a fairly constant level of 2.0 mg/l throughout Lake Weiss.

Figure 7 shows that the principal organic waste load contributing to interstate pollution enters the Coosa River from the Rome Kraft Company paper mill. Otherwise, there are no significant variations in the overall B.O.D. picture.

Dissolved Oxygen (D.O.)

1962 Studies

The dissolved oxygen characteristics of the Etowah, Oostanaula, and Coosa Rivers are posted in Tables No. A-5, A-6, and A-7. Special dissolved oxygen summaries are shown in Table No. 3 and illustrated on Figure No. 8. The bar graph at the top of Figure 8 shows the average, maximum and minimum D.O. and the shaded circles indicate the per cent of samples containing less than the 4.0 mg/l.

Etowah River water is withdrawn from the depths of the Allatoona impoundment where there is little or no dissolved oxygen during a portion of the year. For about 5 to 10 miles below the dam the low dissolved oxygen concentrations, and the pollution discharges discussed elsewhere, made the river unsuitable for the propagation of fish and other normal aquatic life.

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

DISSOLVED OXYGEN SUMMARY

TABLE NO. 3

Etowah, Oostanaula and Coosa Rivers - August 1962

STATION NO.	RIVER MILE	NO. OF SAMPLES	SURVEYS INCLUDED	D.O. (mg/1)			% Below 4.0 mg/1
				MAX.	MIN.	AVG.	
E-8	E-47.3	4	G	2.0	1.6	1.8	100%
E-7	E-44.5	3	G	3.4	2.3	2.8	100%
E-6	E-39.0	16	S	7.5	2.3	4.7	25%
E-5	E-30.4	20	S	7.6	5.5	6.4	0
E-3	E-21.4	16	S	8.6	6.4	7.4	0
E-2	E- 6.4	23	S	8.5	6.7	7.6	0
O-1	O- 1.3	24	S + G	7.4	5.6	6.5	0
C-2	C-275.4	37	S + G	8.5	6.0	6.9	0
C-3	C-268.5	35	S + G	7.4	6.0	6.6	0
C-4	C-265.3	35	S + G	6.8	4.4	5.8	0
C-6	C-256.0	52	S + G	6.6	1.8	3.8	46%
C-7/1-C	C-252.8	72	S + G + A	10.2	1.9	4.3	37%
2-C	C-251.3	20	A	6.0	1.9	4.3	50%
3-C	C-249.6	20	A	8.9	2.6	4.7	40%
C-8/4-C	C-247.9	33	G + A	9.5	3.0	4.6	51%
5-C	C-246.4	20	A	10.1	3.5	5.8	15%
6-C	C-243.6	20	A	8.4	2.8	6.0	10%
7-C	C-240.1	20	A	8.1	3.3	6.0	5%
8-C	C-236.1	20	A	9.4	5.0	7.1	0
9-C	C-234.0	20	A	9.8	4.7	6.9	0
10-C	C-231.0	15	A	9.7	5.6	7.6	0

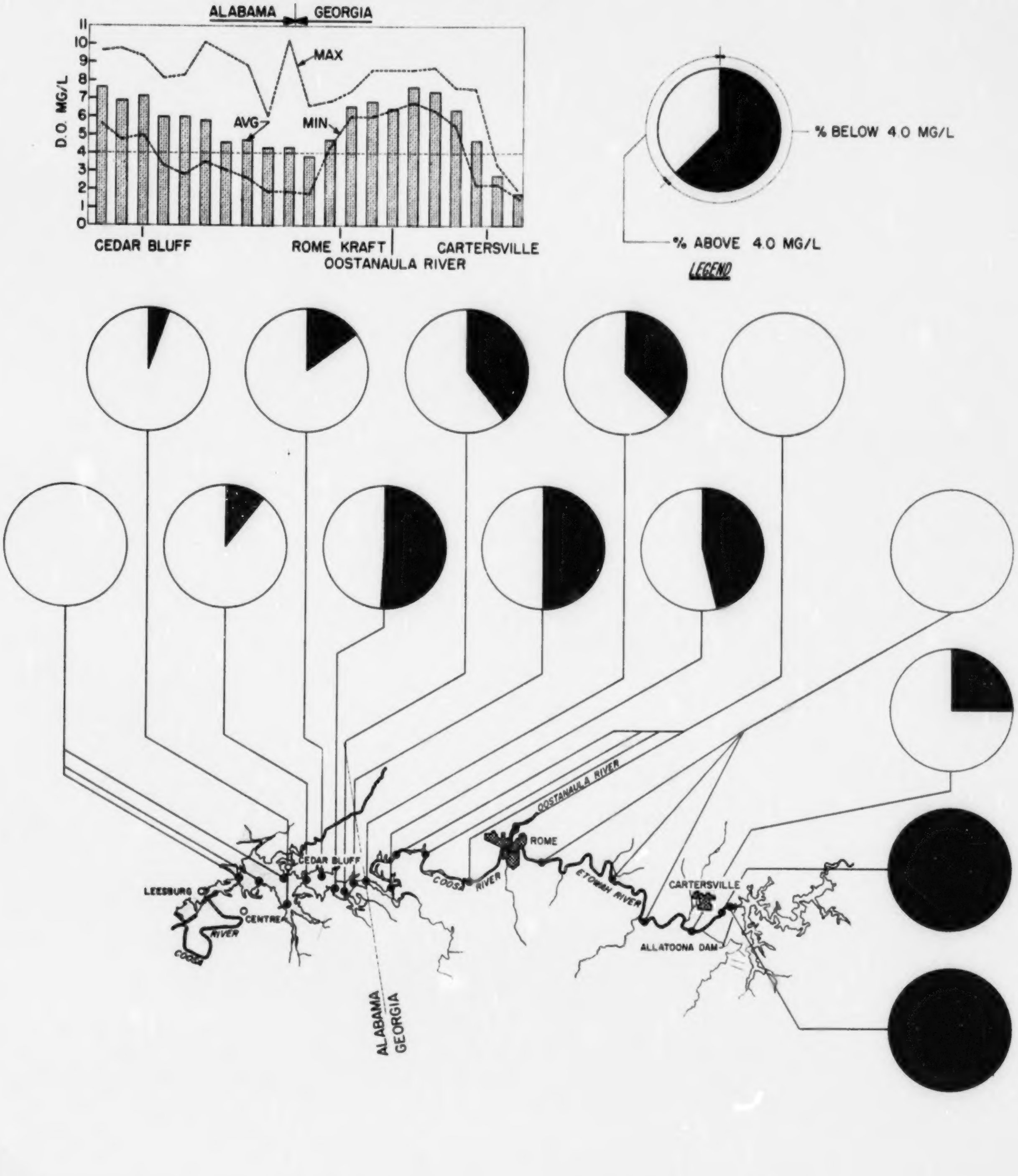
G = PHS GENERAL SURVEY

S = PHS SPECIAL SURVEY

A = ALABAMA SURVEY

COOSA RIVER SYSTEM, GEORGIA — ALABAMA
ETOWAH, OOSTANAULA AND COOSA RIVERS
DISSOLVED OXYGEN
PERCENT OF SAMPLES BELOW 4.0 MG/L — AUGUST 1962

FIGURE 8



For a distance of 3-1/2 miles below the dam the D.O. remained consistently below 4.0 mg/l as it ranged from 1.6 to 3.4 mg/l. At Station E-39.0, some 9 miles below the dam, natural reaeration had increased the average D.O. to 4.7 mg/l, but 25 per cent of the samples contained less than 4.0 mg/l. Throughout the next 35 to 40 miles to Rome the river contained adequate D.O. as the averages increased from 6.4 to 7.6 and the D.O. ranged from a minimum of 5.5 to a maximum of 8.6 mg/l.

Conditions observed in the vicinity of Allatoona Dam are similar to those which frequently prevail at multipurpose flood protection and power production dams where the water levels in the impoundments are raised and lowered according to storage requirements, and turbine intakes are normally located deep in the reservoir.

A number of methods have been proposed to resolve the problems caused by low D.O. at the turbine intakes and to improve water quality below the dams. In a few special cases, for example, submerged weirs have been constructed upstream from the dam to direct the water from nearer the surface, where there is more dissolved oxygen, into the low level turbine intakes. In practice, each specific case requires special study to determine the most appropriate corrective procedure.

The average D.O. concentrations of the Oostanaula and the Etowah Rivers above Rome were 6.5 and 7.6 mg/l respectively. These rivers combined to provide a calculated 7.2 mg/l dissolved oxygen concentration at the confluence.

Sewage and industrial wastes from the Rome area lowered the dissolved oxygen moderately throughout the first 14 river miles to Station C-268.5, which is about 1 mile above Rome Kraft Corporation.

Here the dissolved oxygen ranged from 6.0 to 7.4 for an average of 6.6 mg/l. At Station C-265.3, 2 miles below Rome Kraft, the D.O. remained above 4.0. Downstream from this point and past the Georgia-Alabama State Line, the oxygen demand of the paper mill wastes and the residual organic loading from Rome exceeded the oxygen resources and reaeration capacity of the river. The shaded circles on Figure 8 show that the D.O. fell below 4.0 mg/l frequently throughout the 8-mile reach extending from Station C-256.0, 3 miles above the state line to Station C-247.9, at Poole's Ferry, 5 miles below the state line. In this reach almost half of all samples contained less than the minimum D.O. requirement of 4.0 mg/l. Furthermore, the extreme lows at 3 of these stations above, at, and below the state line dropped to the dangerous levels of 1.8 and 1.9 mg/l.

Below this point the rate of recovery exceeded the residual oxygen demand. The minimum dissolved oxygen requirement was violated 15 per cent of the time at Station C-246.4, 10 per cent of the time at Station C-243.6, and 5 per cent of the time at Station C-240.1, some 13 river channel miles below the state line.

Throughout the rest of Lake Weiss the dissolved oxygen recovered to slightly more than 7 mg/l and remained consistently above 5 mg/l.

Comparison With Previous Surveys

During 1954 the Alabama Water Improvement Commission obtained base line data on the stream before wastes were discharged to the Coosa River by the paper mill at Rome. This study, extending from the state line to below Centre, Alabama, was repeated in 1955 and 1957 after the paper mill started operation, but before Lake Weiss was impounded. The D.O. data collected during these 3 surveys are shown on Figure 9. The results of the 1962 surveys were added to illustrate the total trend from 1954 through the current 1962 survey. Average D.O. concentrations, in mg/l, are shown in the upper family of curves. The minimum D.O. observed at each station during these surveys is shown on the lower chart.

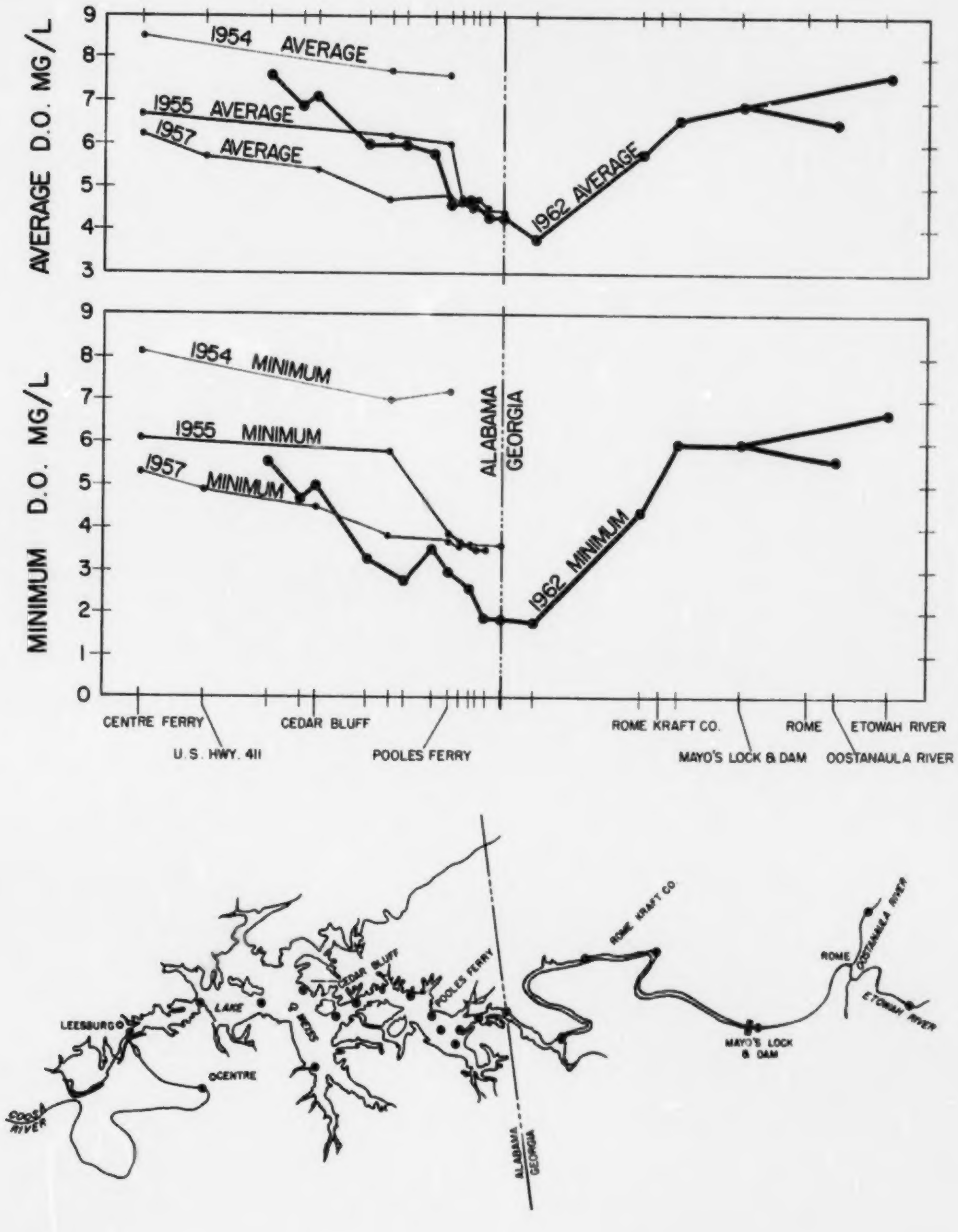
In 1954 the D.O. content of the river was excellent and never fell below 7 mg/l.

The 1955 and 1957 curves show the effects of the paper mill wastes before the power dam was constructed. The D.O. concentration was progressively reduced during this 3-year span. In the vicinity of Cedar Bluff, Alabama, for example, the 1955 D.O.'s were about 1-1/2 mg/l lower than the 1954 values. By 1957 the D.O. had fallen another 1 mg/l. The adverse effects of these wastes were most noticeable in the 5-mile stretch from the state line to Poole's Ferry, where the minimum D.O. for both surveys dropped below the prescribed 4.0 mg/l requirement. Although the averages were slightly above 4.0, the minimums were in the range of 3.6 mg/l.

Lake Weiss, extending from the new Alabama Power Company's dam near Centre, Alabama, across the state line to Mayo's Lock and Dam, some 7 miles below Rome, Georgia, was filled in 1961. The heavy lines of Figure 9 show the August 1962 D.O. concentrations.

COOSA RIVER SYSTEM, ALABAMA - GEORGIA
COOSA RIVER & LAKE WEISS
DISSOLVED OXYGEN
COMPARISON WITH PREVIOUS SURVEYS

FIGURE 9



Three major events occurred since the 1957 survey. Paper mill waste treatment facilities were constructed and placed in operation. Paper mill production was about doubled during August 1962, and the treated effluent load exceeded the previous untreated waste load. The Lake Weiss impoundment reduced stream flow velocities, increased depths, eliminated riffle areas, and reduced the rate of reaeration below Mayo's Lock and Dam.

Portions of the August 1962 curves above the state line show how the organic pollution loads from the Rome area and the paper mill wastes from Rome Kraft Company reduced the average and minimum dissolved concentrations to 3.8 and 1.8 mg/l respectively. For a few miles below the state line the averages did not change materially from the 1955 and 1957 values.

The minimums, however, definitely revealed the damaging effects of increased pollutional loadings accompanied by decreased stream reaeration. The D.O.'s ranged from 1.8 to 1.9 mg/l between the stations just above and below the state line.

D.O. began to recover at about Poole's Ferry and continued to improve down to Cedar Bluff, Alabama. At Cedar Bluff the minimums increased to 5 mg/l and the average D.O. was slightly over 7. Downstream from this point the D.O. of the impounded water was higher than the river water D.O. had been in 1957, and the average D.O.'s exceeded both the 1955 and 1957 levels.

In Summary, Figure 9 shows that the water quality at the Georgia-Alabama State Line has been progressively degraded since 1954.

Increased waste loadings and reduced stream reaeration rates in the reach above the state line reduced the minimum D.O. concentrations to the dangerously low level of 1.8 mg/l. Natural purification in Lake Weiss proper increased the oxygen content and, under August 1962 loading conditions, restored it to satisfactory levels at and beyond Cedar Bluff, Alabama. Although the average D.O. of all samples collected at the state line was about 4 mg/l, almost 50 per cent of the samples collected throughout a 15-mile reach in this area contained less than this minimum requirement.

Sewage and industrial waste pollution from the Rome area and the Rome Kraft plant, has frequently reduced the Coosa River and upper Lake Weiss dissolved oxygen content below levels considered suitable for fish propagation.

Conditions were critical during August 1962. If the declining dissolved oxygen trend continues, extensive fish and aquatic life habitats above and below the state line will be destroyed.

Hydrogen Ion Concentration (pH)

pH levels in the Etowah, Oostanaula, and Coosa Rivers and Lake Weiss were satisfactory.

The pH of the Etowah River ranged from 6.4 at Allatoona Dam to 7.2 at the mouth in Rome, Georgia. A value of 7.3 prevailed in the Oostanaula River.

The pH of the Coosa River from Rome, Georgia, down across the state line and to Poole's Ferry in Alabama was about 7.0. In Lake Weiss proper, the pH increased slightly to range from 7.0 to 8.0.

Color

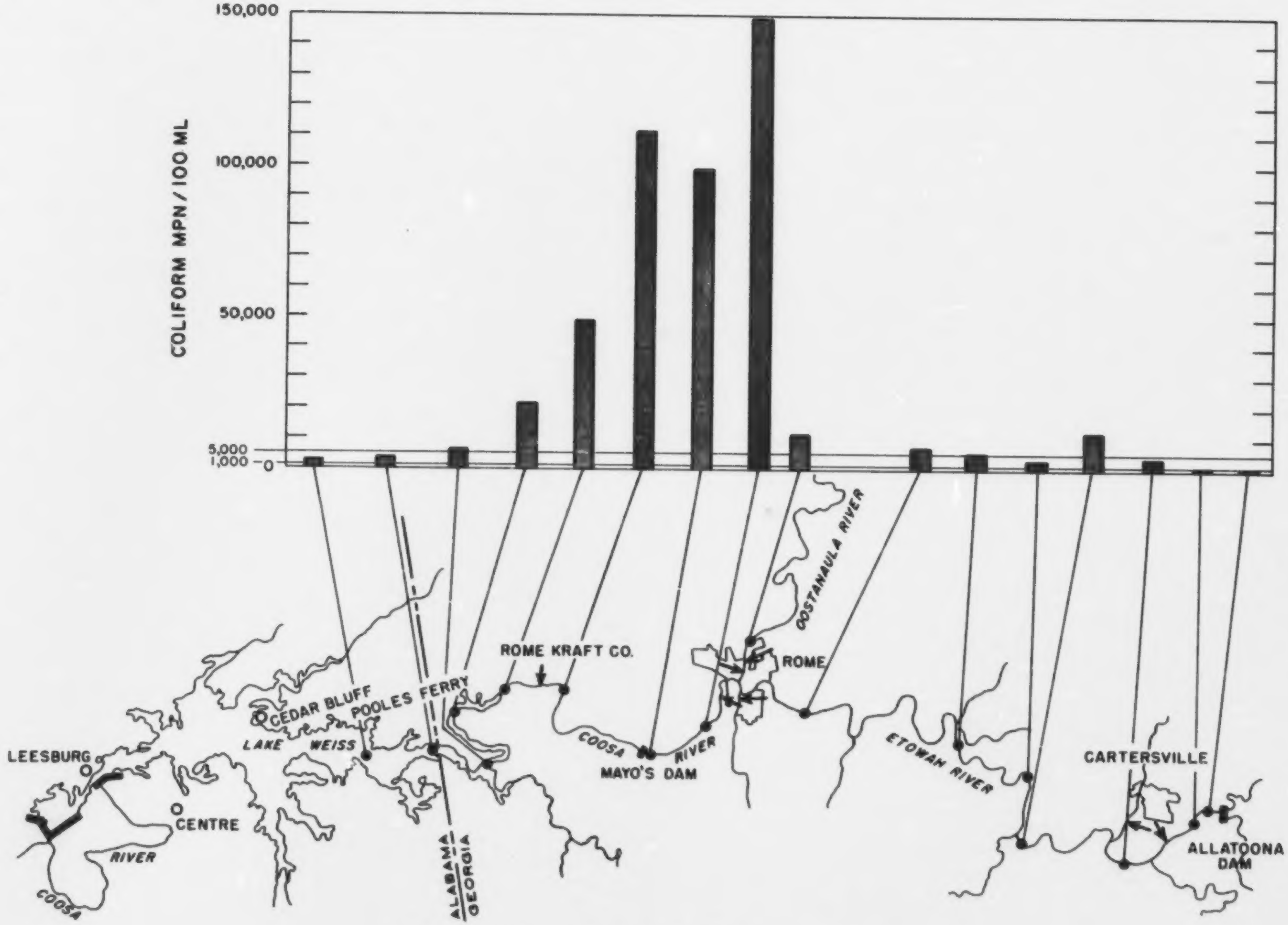
The color intensities of these waters, as determined by Standard Methods, are posted in Tables No. A-5 and A-6. In the standard color test, the water sample is centrifuged to remove suspended material before the solids-free liquor is compared with color standards. This test measures the intensity of dissolved color but does not generally show the influence of suspended silt or turbidity on the over-all appearance of the waters.

Water at the first station below Allatoona Dam contained 25 color units. An average of 15 color units was observed at the next station just above Cartersville. Downstream in the Etowah River and in the upper 14 miles of the Coosa River below Rome the color, ranging from 17 to 24 units, did not change significantly. The color increased to 35 units just below the Rome Kraft waste outfall. From this point down across the state line to Poole's Ferry in Alabama, the average color remained fairly uniform in range from 30 to 35 color units.

The apparent color and general appearance of these waters vary with the suspended sediment loads which are discussed in a subsequent section on Silt.

Coliform Bacterial Density (MPN per 100 ml)

The average coliform bacterial densities, expressed in MPN per 100 ml, are posted in the Summary Tables No. A-5 and A-6, and shown on Figure 10. Above Cartersville, the Etowah River waters released from Allatoona Dam contained approximately 1,000 coliform bacteria per 100 ml.



COOSA RIVER SYSTEM, GEORGIA-ALABAMA
ETOWAH, OOSTANAULA AND COOSA RIVERS
COLIFORM BACTERIA
AVERAGE MPN / 100 ML - AUGUST, 1962
FIGURE 10

At Station E-39.0, approximately 2 miles below Cartersville, the coliform count increased to 4,000. The coliform density of Pettit Creek below Cartersville was 5,000,000 MPN/100 ml. At Station E-30.4, approximately 10 miles below Cartersville, the coliform density averaged 12,500 per 100 ml.

The average coliform densities at the remaining 3 downstream Etowah River stations were approximately 3,000, 6,000, and 7,000 per 100 ml respectively.

Raw domestic sewage pollution entering the river from the Cartersville area increased the coliform bacteria significantly above the 1,000 per 100 ml level commonly accepted as satisfactory for bathing, swimming, and other water contact sports.

The coliform content of the Oostanaula River entering Rome averaged 11,000 per 100 ml. The Silver Creek tributary, containing industrial wastes and treated sewage from Lindale, averaged 124,000 coliforms per 100 ml.

About 1 mile below Rome the coliform content of the Coosa averaged approximately 150,000 per 100 ml. The count dropped slightly to approximately 110,000 at Station C-268.5, some 11 miles downstream. The coliform count continued to decrease to an average of 3,500 at the state line and approximately 2,400 per 100 ml at Poole's Ferry, approximately 5 miles below the state line.

During August 1962, the coliform content of the Oostanaula River above Rome exceeded the levels considered satisfactory for domestic water treatment plant sources. Raw sewage from Rome contaminated the waters of the Coosa River and upper Lake Weiss. The waters from Rome down to at least 5 miles below the state line were unsatisfactory for water contact sports.

Biological Studies

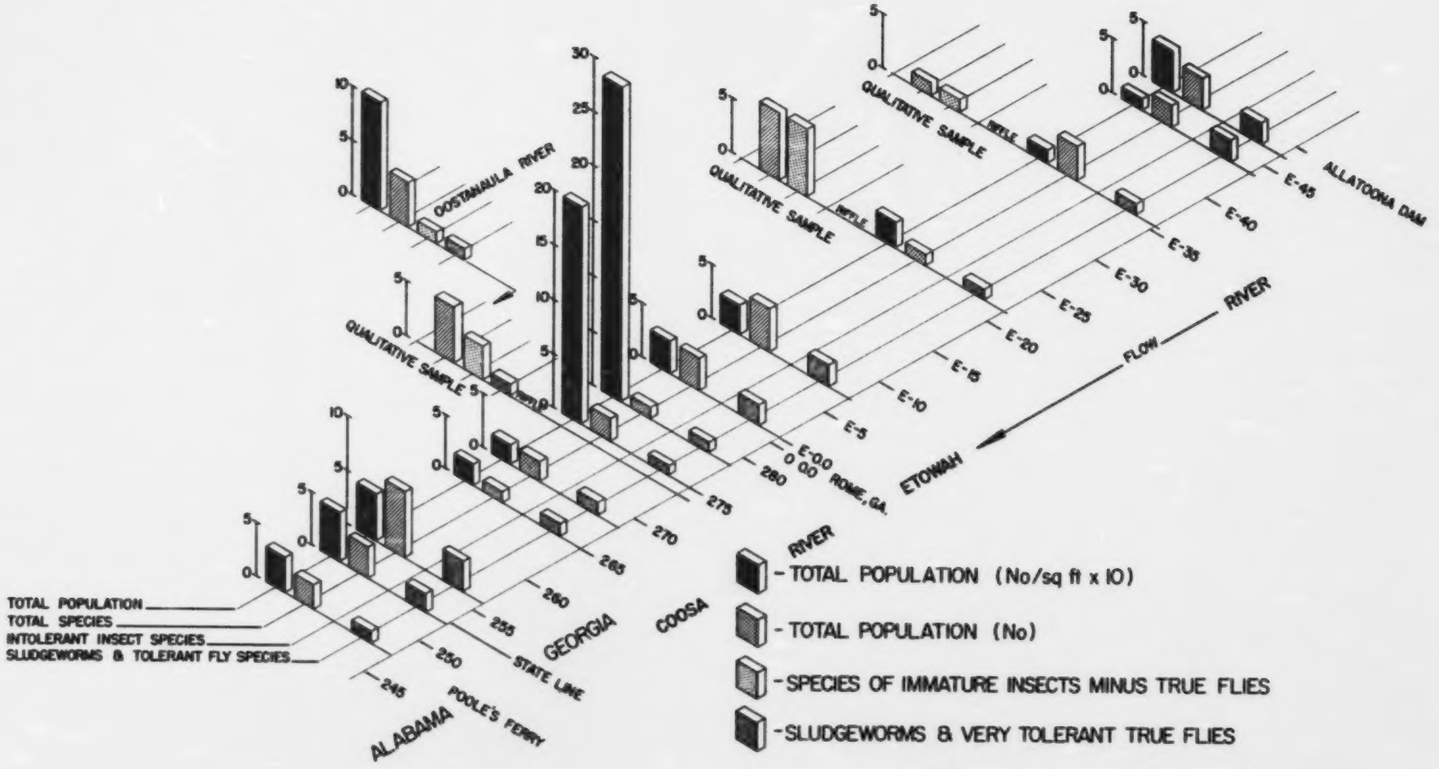
Bottom Organisms

The effect of organic wastes and toxic substances on the benthos, or bottom organisms, was described in the Chattooga River discussion. Additional factors influence the benthic population of the Etowah and Coosa Rivers.

Deposition of silt and other particulate material on the stream bottom affected the quantitative and qualitative distribution of the benthos. The processes of erosion or deposition of mining debris greatly increased the relative proportion of finer materials in the stream bed and reduced the number of usable habitats in which organisms may live. These deposits were principally inorganic in nature and the combined impact of deposition and the abrasive action of the sand carried by strong currents was so great that the potential population response to organic waste was not observed.

The paucity of benthic organisms existing in the Etowah and Coosa Rivers is illustrated in Figure 11. Only a small number of species was found at each of the sampling stations. Furthermore, most of the benthic organisms were tolerant of pollution (sludgeworms, midges, and associated forms).

COOSA RIVER SYSTEM, ALABAMA—GEORGIA
ETOWAH, OOSTANAULA AND COOSA RIVERS
BENTHIC POPULATION
FIGURE 11



The discharge through Allatoona Dam was from a depth in the reservoir which was devoid of dissolved oxygen. As a result, the benthos immediately below the dam consisted of a few very tolerant forms. The water was very clear, however, and pondweeds and eelgrass were found growing in extensive beds along the shore. Green filamentous algae were also found along with *Crenothrix* and other iron bacteria which deposited a reddish-brown floc over much of the vegetation and portions of the bottom near shore.

A short distance downstream the silty mineral washing wastes discharged by New Riverside Ochre Company created a bottom unsuitable for most benthic forms. The resulting low populations persisted for the remaining length of the Etowah River. At Station E-34, sampling of a rock and riffle area revealed 3 immature mayflies as the only insects bearing visible external gills. Iron bacteria were found at this station but were not found at any point farther downstream in the river system.

Again, in a shallow riffle area near Station E-21.4 just above the Highway 411 bridge, several species of intolerant immature insects were found, including hellgrammites and 1 immature stonefly. The benthic population was extremely low in the riffle, as well as along the banks of the river near shore. At the 2 succeeding stations on the Etowah River, little change was found in those shore line areas. Pondweeds, eelgrass, and other higher aquatic plants were not found below the entrance of the silt from the mineral washing operations.

Samples were collected from the Oostanaula River just above the Rome water intake. Figure 11 shows that although the natural silt deposited along the stream banks did not support a large variety of organisms, the majority of the species were pollution intolerant types, which are normally associated with cleaner waters. Immature burrowing mayflies were noted in numbers approaching 100 organisms per square foot in these areas. Gill-breathing snails were prevalent. Clam shells on the banks indicated that at least 5 genera of unionid clams had lived in the vicinity. It is highly significant that these intolerant forms, normally associated with clear water, were not found in any similar habitats in the Etowah or Coosa Rivers.

The first 2 sampling stations on the Coosa River, approximately 4 and 7 miles below Rome, showed the adverse effects of raw sewage and industrial wastes discharged to the river at Rome. At these stations the sludgeworm population increased to an average of 200 to 300 per square foot; a 6-fold increase over other samples collected from the Etowah River.

One mile downstream organisms were found on rocks in the swift current below Mayo's Dam. Pollution sensitive hellgrammites and immature caddisflies and mayflies occurred, although total population numbers were very low.

From Mayo's Dam downstream, the benthic population along the margins of the Coosa River consisted of low numbers of tolerant forms, such as sludgeworms, midges, nematodes, and an occasional leech.

The importance of bottom organisms to the economy of an aquatic community has been recognized in the past and is currently receiving renewed emphasis. For example, similar studies in other parts of the country have shown marked reduction in organims below the discharge of gravel washing operations. In another stream the production of fish food organisms dropped to almost nil during siltation below a gold dredge operation. One year after the dredge closed operations the silt was flushed from the pools and riffles by freshets and the bottom organisms increased 8 to 10-fold. Other studies have shown that destruction of fish food organisms is frequently a serious limiting factor, and an inadequate food supply is a most common cause of poor fishing quality in lakes and streams alike.

This study demonstrates the impact of the silt and sand deposition upon the biota, both in restricting biotic development to certain pollution tolerant forms and limiting total production within the biotic population. This unfavorable feature of the aquatic environment persists down to and across the state line into Alabama.

Algal Examination

Algae and vegetation are affected by silt principally by (1) covering the bottom material with a layer of sediment, (2) a reduction of light transparency and prevention of light penetration, and (3) a grinding action of the particles. A reduction of plant food is accompanied by a reduction on the poundage of plant-feeding animals that can be supported, and this in turn limits the production of carnivorous animals, including fish. Algae are the foundation of fish food chains. Shad, for example, live on algae and in turn are food for game fishes.

Algal samples were collected from a depth of 2 feet at 3 locations in the Etowah River, 1 point in the Oostanaula River, 4 points in the Coosa River, and 1 point near the center of Lake Weiss (Table A-8, Figure 12).

The water which forms the Etowah River below Allatoona Dam was taken from the depths of Lake Allatoona during summer. At times of turbulent discharge a strong odor of hydrogen sulfide was emitted. A short distance below the dam the water was still very clear and an algal population (Table A-8) had not had an opportunity to develop. Five genera of algae other than diatoms and 9 species of diatoms were found at this station. Over 50 per cent of algal numbers were composed of a blue-green alga, and the diatom population was very low compared to other stations.

Twenty-five miles downstream in a region exposed to the effects of silt turbidity, the algal population was low (126 per ml), and the genera of algae other than diatoms were reduced to 2.

Farther downstream, just above the confluence with the Oostanaula River, the diatom population had increased slightly, but no algae other than diatoms were found, thus showing the adverse effect of silt turbidity on the development of an algal population.

On the Oostanaula River, 1.3 miles above its confluence with the Etowah, the algal population was 10 times more abundant than at any place sampled on the Etowah River. The diatom flora composed over 50 per cent of the algal population while the small coccoid green algae formed the next most abundant group. The population included 10 algal genera excluding diatoms and was composed of all major algal groups.

Two miles below the junction of the Oostanaula River with the turbid waters of the Etowah River, the algal data indicate both a reduction in genera and in numbers to form a population of less than half of that recorded for the Oostanaula River, again demonstrating the adverse effect of silt. Thirteen miles farther downstream there was a further reduction both in kinds and number indicating a die-off of algae from the Oostanaula River when it enters the Coosa River. Only 2 genera of algae other than diatoms were encountered.

Just below the state line, at Station C-252.8, the algal population indicated recovery with a marked increase both in the number of genera and total population. Although the population was not so large as in the Oostanaula River, the relative distribution of the broad groupings was similar. Five miles downstream in the region of Poole's Ferry, algae were collected during a time of moderately strong wind, water mixing and high turbidity. The effect of increased turbulence and mixing upon the algal population was clearly shown in a reduction in types, as well as a marked reduction in numbers per ml. All groups were affected by the adversities of the environment, and the diatoms were reduced to one-fourth of their number at the state line.

A sample collected at a 2-foot depth near the center of Lake Weiss showed a population with more algal cells per ml than any other sample collected in the study. Diatoms composed 85 per cent of the population, but other groups were represented by a number of genera. Protozoa and 6 genera of rotifers were present in a quantity of 56 per L. These latter forms were not present in the river samples.

Incident Light

Incident light is necessary for algae and higher aquatic vegetation to live. Algae are basic in the aquatic food chain. Algae also utilize carbon dioxide and water and, in the presence of light, produce oxygen in support of the D.O. balance in a normal stream. With insufficient light, the population of these aquatic plants is reduced and their normal benefits to a stream are lost.

The limit for growth of higher aquatic plants lies between 2.5 and 3.5 per cent of the total surface light energy at bottom depth. There is evidence that certain algae can grow at levels of 1 per cent of the incident light.

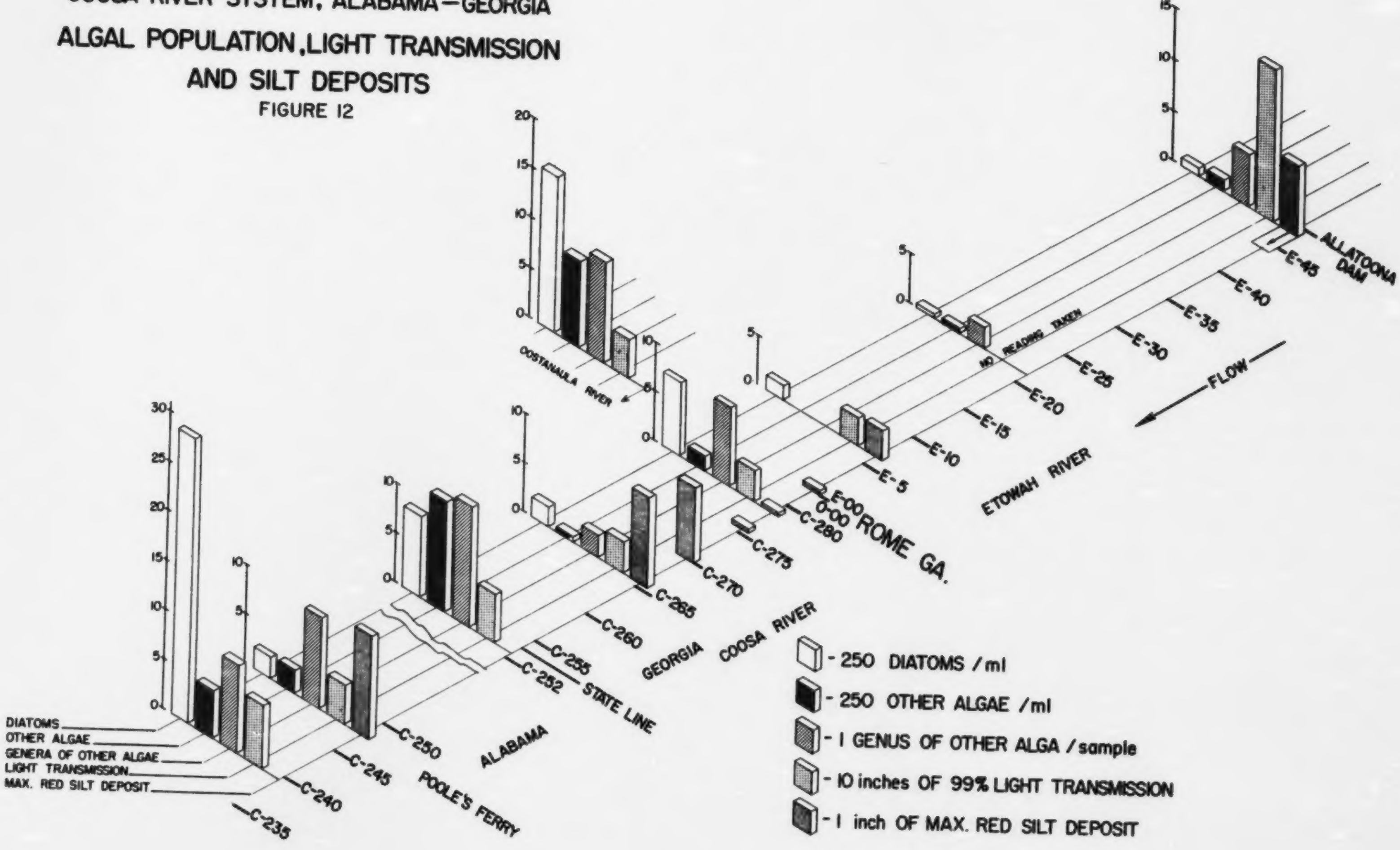
The depths at which a given percentage of incident light remains in the Coosa System are shown in Table A-9 and Figure 12. Light transmission is affected by turbidity, which may consist of both inorganic silt and algae.

The water as it left Allatoona Reservoir was clear. Ten per cent of the incident light remained at the bottom (60 inches of water) in the center of the stream. Downstream on the Etowah River below Station E-6.4, the water carried reddish silt and 1 per cent of the incident light remained in only 26 inches of water. Since the algal population was very low at this location, the low transparency was attributable to the inorganic silt load. The potential for algal development at this station was restricted to about 2 feet by the availability of light and further hampered by the physical action of the silt on algal cells.

COOSA RIVER SYSTEM, ALABAMA—GEORGIA

ALGAL POPULATION, LIGHT TRANSMISSION AND SILT DEPOSITS

FIGURE 12



The Oostanaula River was carrying a dense algal growth at the time of study. One per cent of the incident light remained at 37 inches and 2.5 per cent remained at 30 inches. The low light transparency at this point was principally caused by suspended algae. A bloom, or extremely heavy growth, of algae was present on the surface of the river at the time of the light transparency readings.

Light transmission was again restricted on the Coosa River, and since the algal population was low, silt was the contributing factor. The depth of effective light penetration gradually increased until at the state line 1 per cent of the incident light remained at a depth of 48 inches and 2.5 per cent of the incident light remained at 37 inches. At Poole's Ferry, light readings were taken at a time when surface winds were strong and there was mixing of the water. Undoubtedly, silt from the lower water layers and lake bottom became redistributed throughout the water resulting in a reduction of the 1 per cent light transmission zone to 39 inches.

A station near the center of Lake Weiss yielded the greatest algal population found during the survey (8,383 per ml) as well as the deepest light transmission zone with 1 per cent of the incident light penetrating to a depth of 65 inches.

As a control point, photometer readings were taken from the bay of Lake Weiss into which the Chattooga River discharges. Light transmission at this point was similar to that of Lake Weiss, extending to a depth of 53 inches and 2.5 per cent of the incident light was present at a depth of 41 inches.

Fish

Preimpoundment fish population studies of the Coosa and Chattooga Rivers were made by Dr. Homer S. Swingle, Alabama Polytechnic Institute, under contract with the Alabama Water Improvement Commission, and in cooperation with the Alabama Department of Conservation (Table A-10). Rotenone was used to collect fish samples. The Coosa River studies were conducted near Sewell Ferry, which is about 10 miles below the state line. The Coosa River was muddy at the time of sampling at both the station 2-1/2 miles above Sewell Ferry and 2-1/2 miles below Sewell Ferry. Approximately 1 acre in area was sampled on the Coosa River, and the depth of water at the sampling points varied from 14 to 16 feet. On the Chattooga River a 0.5 acre sample area was used, and at this location the depth ranged from 3 to 9 feet, with an average of 6 feet. For the purposes of comparison in Table A-10 these data were converted to the acreage basis.

The report, dated December 1958, states that the fish population in the vicinity of Sewell's Ferry was in good balance, but over 50 per cent by weight were composed of redhorse suckers. In the upstream sample area game fish made up only 0.4 per cent by weight of the population and in the downstream sample area only 5 per cent by weight. The principal game fish present were spotted bass, walleye, black crappie and bluegill. Largemouth bass, the most desirable of the sport fishes, was absent from this area of the Coosa River. Blue, channel and flathead catfish were present and are expected to expand into a valuable part of the impoundment population.

The Georgia State Game and Fish Commission conducted an electrofishing survey on the Coosa River 9 miles below Rome on September 3, 1959. Forty-four fish were captured, 20 of which were game fish. The game fish included 1 largemouth bass, 1 spotted bass, 16 bluegills, 1 yellowbelly sunfish and 1 longear sunfish, and made up 21.5 per cent by weight of the total fish composition.

The results of a current electrofishing survey(1-hour duration) on the Oostanaula River above Rome, the Coosa River 2 miles below Rome, and on the Coosa River 2 miles below the Georgia-Alabama State Line are comparable (Table A-11). A similar number of game species were found at each station and no great difference in size was noted. There was an indication, however, of a larger population of carp in both Coosa River samples and of shad in the Coosa River sample below the state line.

The creation of Weiss Reservoir improves the fishing potential in the tributary streams because it serves as a constant supply source, from which fish can migrate into the tributary streams from the reservoir.

Silt

Direct damage to fish by sediment has not been determined. In most cases indirect damage to the fish population through destruction of the food supply, eggs, or changes in the habitat probably occur long before adult fish are directly harmed.

It has been found that silt is not very dangerous to fish eggs and developing fry in the normal stream if excess occurs only at intervals; however, the character of such normal streams can be drastically altered by allowing the washings of quarries, gravel pits, mines, etc., to flow into the stream untreated. Continuous application of even small quantities of silt over spawning beds may be extremely detrimental to the welfare of very young fish. From a practical standpoint the damage to fish spawning beds occurs when mining silt enters a stream at times other than storm periods when the water velocity is insufficient to carry the sediment in suspension.

Turbidity reduces the enjoyment of fishing and limits the success in terms of fish caught. In clear water the field of fishes' vision increases and they are able to see food at increased distances. Work at Fork Lake, Illinois, indicates that approximately 6.5 fish were caught per man hour of fishing when the water transparency was measured at 4 feet, whereas, only 2 fish were caught per man hour when water transparency was limited to 0.5 - 2.0 feet.

Only a small amount of sand or silt shifting in and around the gravel of the bottom eliminates much of the area suitable for the attachment or hiding of the aquatic insects, and drastically reduces the total production of these forms. Small amounts of sand not discernible by casual inspection, but evident only on close examination of the bottom materials, can bring about significant changes.

Settleable solids may promote a number of changes within the environment: (1) blanket the substrate, (2) screen out light, thus restricting bottom plants and floating algal forms, (3) floc planktonic algae out of the water and carry it to the bottom to die, (4) change head radiation, (5) retain organic materials and other substances which create unfavorable conditions on the bottom, (6) interfere with fish feeding, (7) smother fish eggs, and (8) produce a grinding and crushing action deleterious to benthic forms.

Observations indicate that heavier silt and sand particles continually roll downstream in the Etowah River, temporarily settling above riffle areas and becoming resuspended immediately below as the current pushes the particles over the riffles. This phenomenon produces a muddy water appearance below shallow obstructions in the main channel. Any type of current deflector on the bottom in the center of the stream causes immediate settling of silt on the downstream side of the obstruction.

A thin layer of fine silt gradually settles into the bottom sand in the channel during times of low stream flow. At times of substantially increased flow, the silt is rolled up and resuspended from the sandy bottom by the force of the current and forms clouds of red water.

In regions of reduced stream velocity along the stream bank and downstream from an inside meander, the silt settles and deposits on the bottom substrate. A reduction in stream velocity also occurs in the upper end of Lake Weiss with the resultant build-up of silt on the bottom of the flowage in the region of the old channel (Table A-12).

Silt was found in the center of the channel adjacent to Poole's Ferry (Lake Weiss) and in the downstream vicinity. A depth of 10-1/2 inches was reached at Poole's Ferry. Approximately 1 mile downstream, the channel deposition had been reduced to 4 inches and another mile downstream 3 inches of silt were found.

Barium, which occurred in the mineral ores but not in soil erosion sediments, was used to trace the deposition of mineral washing waste solids in the Etowah and Coosa Rivers. Barium was found in the Etowah and Coosa River core samples (Table A-13). Barium was not found in core samples collected from the Oostanaula River and Pumpkinvine Creek above Highway 41. These data indicate that mining silts containing barium, that are introduced into the Etowah River, are carried into the Coosa River eventually reaching the upper end of Lake Weiss in Alabama. Greatest silt deposition (10-1/2 inches) occurred near the upper end of Lake Weiss, River Mile 247.9 (Table A-12) where 4.7 mg/g (dry weight) of barium was found. The largest concentration of barium was found in the New Riverside sludge pond (10.8 mg/g) and at River Mile E-44.5 in the Etowah River (7.0 mg/g).

SUSPENDED SEDIMENT LOADS

AUGUST 1962 SURVEY

Introduction

Knowledge of periodic waste discharge schedules and cyclic river flow patterns is necessary for an understanding of suspended sediment loads in this river system.

The New Riverside Ochre Company discharges about 500 tons per day of clay into the Etowah River at River Mile E-46.3 between Allatoona Dam and Cartersville. This plant operated on a five-day workweek from Monday through Friday. Clays washed from raw ore flowed to an intermittent holding pond during each operating day. About 8:00 P.M. each evening, low level sluice gates were opened and the ponded wastes were sluiced to the river during a 45 to 60 minute draining period.

Operations at this plant during the August survey appeared similar to those observed during the earlier July 1962 preliminary survey. Most solids discharged to the river during the evening periods of low river flow settled out and remained in the discharge area overnight. When the Allatoona Dam turbines were opened the next morning, the swift turbulent river current scoured the river bottom, resuspended the settled solids and carried the accumulated clay and silt load downstream.

The Thompson Weinman Company processes barites ores at their Paga Mines near Cartersville. Clays washed from the raw ores are discharged to three large holding ponds covering some 160 acres. Supernatant liquor withdrawn from these ponds enters the Etowah River near the Cartersville sewer outfall at River Mile E-40.8, between sampling Stations E-44.5 and E-39.0.

These waste holding ponds were observed on July 18 during the preliminary field survey. One pond had been drained to the bottom of the outlet control box and small quantities of silty wastes continued to flow out through the leaking gate structure. A large depression had been scoured out of the exposed accumulated sludge mass. This cavity in the pond bottom and the presence of mud shoals along the sides of the outlet ditch showed that large quantities of clay had been sluiced through the holding pond and out into the river. This condition was called to the company's attention and the pond operating procedure was corrected shortly thereafter.

During the August survey, Thompson Weinman Company exercised diligent supervision over these ponds and obtained excellent solids removal efficiencies. In fact the suspended solids concentration of eight samples, collected from the pond with the greatest outflow, ranged from 15 to 105 for an average of 34 mg/l. Based on a total estimated outflow of 1 million gallons per day this would amount to only 0.14 tons of solids per day. These results prove that proper supervision and operation of waste holding ponds can practically eliminate mineral washing silt pollution of the Etowah River.

River Discharge

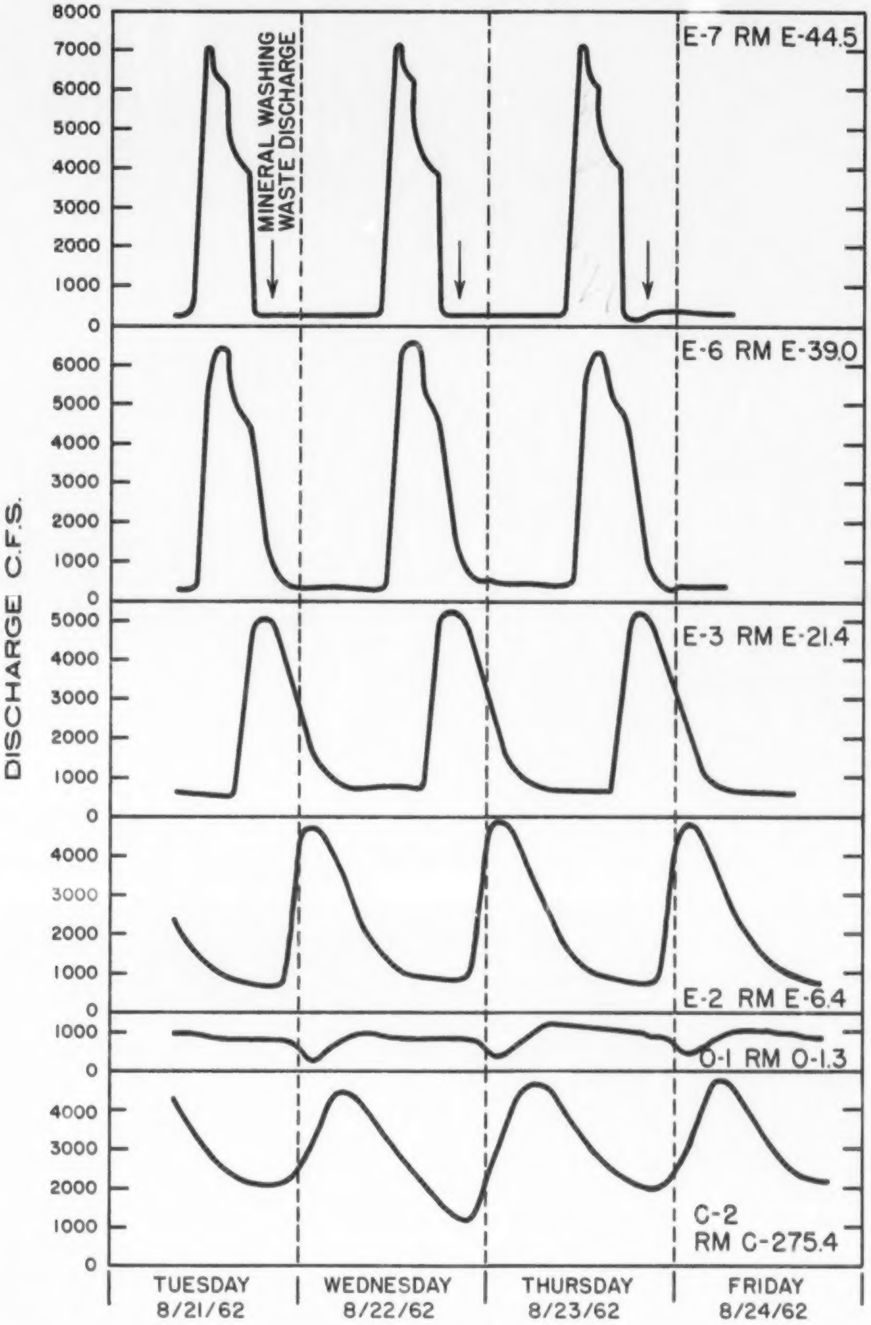
A general reference summary of river discharge data obtained during the 1962 survey is posted on Table No. A-14.

Hydrographs showing the diurnal discharge variations at the Etowah River sampling stations are shown on Figure 13. These hydrographs and 1962 stream flow studies are based on provisional discharge data furnished by the U. S. Geological Survey and the U. S. Army Corps of Engineers.

Minimum Etowah River flows of approximately 300 cfs occurred throughout the evening and early morning hours when the Allatoona Dam turbines were shut down. During the August special study period, the first turbine, releasing approximately 3500 cfs, was opened at 11:00 A.M. The second turbine was opened at noon and the flow increased to approximately 8,000 cfs. At 2:00 P.M. the first turbine was shut down and the flow gradually subsided from 5,000 to 4,000 cfs. At 6:00 P.M. the second turbine was also shut down and the river flow again returned to the minimum 300 cfs rate.

The top hydrograph of Figure 13, showing the Etowah River discharge at Station E-44.5, some 2 miles below New Riverside Ochre Company, parallels the Allatoona Power Dam turbine operating schedule. The low, 300 cfs, flow prevailed for about 17 hours and then climbed rapidly to a 7,300 cfs peak at 12:15 P.M., a little over an hour after the turbines were opened.

COOSA RIVER SYSTEM, GEORGIA - ALABAMA
ETOWAH, OOSTANAULA AND COOSA RIVERS
DISCHARGE
DIURNAL VARIATIONS OF INSTANTANEOUS RATES IN C.F.S.
FIGURE 13



During the next 6-hour period the flow subsided according to the turbine operating schedule and shortly after 6 o'clock it returned down to 300 cfs.

About 5 miles downstream, at Station E-39.0, a similar discharge pattern prevailed but the peaks were not quite so sharp and the changes in discharge rates were not so abrupt. At this station, located some 2 miles below the Thompson Weinman facilities, the flow reached a 6,500 cfs peak approximately 3-1/2 hours after the turbines were opened.

At Station E-6.4, located about 6-1/2 miles above the Etowah River mouth in Rome, the cyclic pattern was still evident but it had leveled off to range from about 700 to 4,500 cfs. At this station the peak occurred about 1:30 A.M., some 14-1/2 hours after the turbines were opened.

Flow in the Oostanaula River in Rome normally ranged between 800 and 1,000 cfs except for an early morning low when the water surface elevations at the mouth were influenced by the peak Etowah River flow.

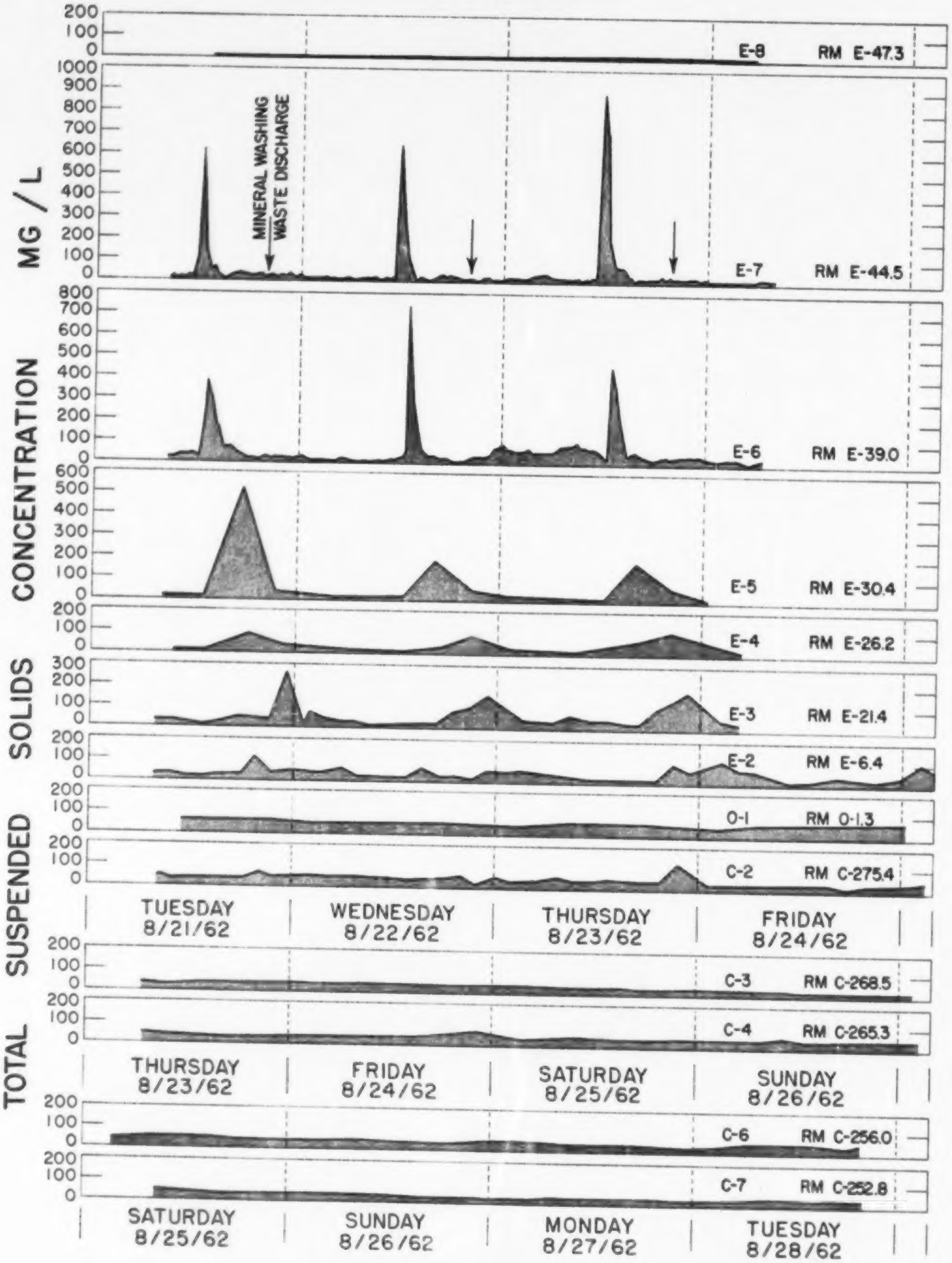
The more regular undulating flow pattern of the Coosa River at Station C-275.4, reflects the combined flow characteristics of both the Etowah and Oostanaula Rivers at their confluence some 7 miles above this point. The low daily discharge rate, of about 2,000 cfs, occurred around 8:00 P.M. and the flow then rose to a 4,600 cfs peak about 6 o'clock in the morning.

Suspended Sediment

The suspended sediment loads consisting of silts, clays and some fine sands that caused the turbidity and contributed to the apparent color of the Etowah, Oostanaula, and Coosa Rivers are shown on Figures 14 and 15. Figure 14 shows the diurnal variation in suspended solids

COOSA RIVER SYSTEM, ALABAMA—GEORGIA
ETOWAH, OOSTANAULA AND COOSA RIVERS
TOTAL SUSPENDED SOLIDS
DIURNAL VARIATIONS OF CONCENTRATION IN MG / L

FIGURE 14

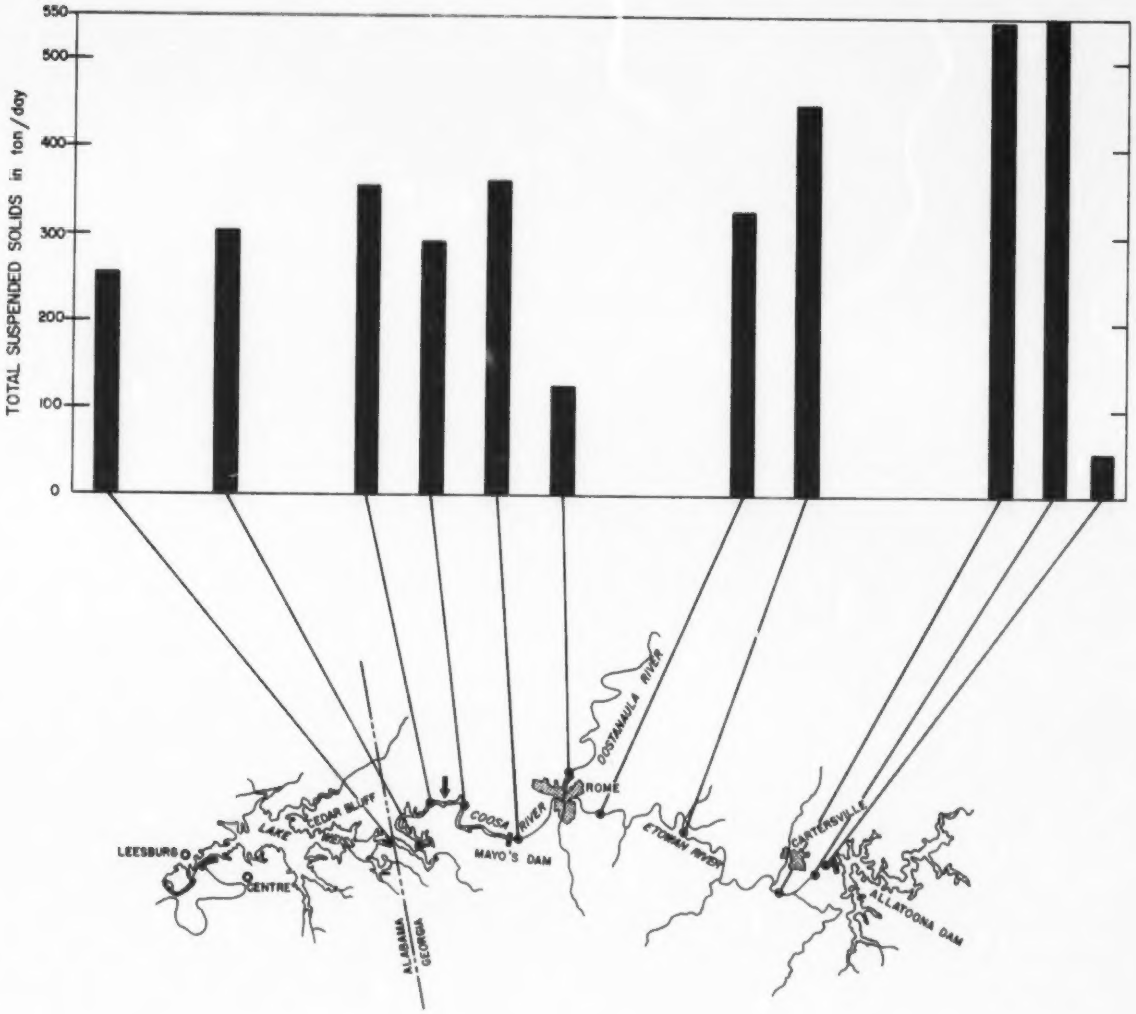


COOSA RIVER SYSTEM, ALABAMA—GEORGIA
ETOWAH, OOSTANAULA AND COOSA RIVERS

TOTAL SUSPENDED SOLIDS

AVERAGE MASS IN TONS/DAY

FIGURE 15



concentrations and Figure 15 shows the average mass of suspended solids flowing down the river system. The mass suspended sediment load was calculated from discharge and suspended solids data collected during the August survey. A summary of the data collected during this special round-the-clock survey is shown on Tables A-15 and A-16. The mass of suspended sediment, computed from frequent round-the-clock discharge and solids determinations, is posted in Table No. A-15.

No discharge records are available for the Coosa River from Mayo's Lock and Dam to the state line. The discharge was assumed to approximate the averages observed at the Coosa River gage at Mayo's Lock and Dam. The mass of solids in this reach was calculated from measured solids concentrations and estimated discharges, and posted in Table A-16.

The sediment load suspended in the river waters does not include the bed load or the heavier solids that gravatate to the river bottom and then slide, tumble, or roll downstream along the river bottom without becoming resuspended in the upper water layers. Bed loads were not determined.

The clear water released from Allatoona Dam and flowing past Station E-47.3 contained very little suspended sediment. Here the suspended solids concentration ranged from 10 to 15 mg/l for an average of 12.5. The total mass amounted to 56 tons per day.

At Station E-44.5, some 2 miles below the New Riverside Ochre Company, the suspended solids concentrations were as low as 5 mg/l during the nightly low flow portion of the 24-hour cycles. During low flows, the Etowah River was quite clear and contained only a slight shade of grayish-tan color.

The color and turbidity increased sharply around 11:30 A.M., about one-half hour after the turbines were opened. During the next hour the suspended solids concentrations increased to 900 mg/l peaks, and the color turned deep reddish-tan as most of the waste solids, which had been deposited the previous evening, were resuspended and flushed past this station. The suspended solids concentration subsided from about 12:30 A.M. to 2:30 P.M. and remained at or below 25 mg/l during the next 20 hours of the daily cycles.

The arithmetic average suspended solids concentration of 120 samples collected from this station during the special study was 52 mg/l. As shown on the bar charts, approximately 550 tons per day of suspended solids were carried past this station. Approximately 500 of this 550 ton total was discharged by the New Riverside Ochre Company.

At Station E-39.0, below the Thompson Weinman facilities, the general suspended solids concentration pattern was similar but the peaks were somewhat flattened. Here the concentrations ranged from 10 to 750 mg/l for an average of 61 mg/l. The peak occurred approximately 2 hours after the Allatoona Dam turbines were opened. Increased concentrations during the morning of Thursday, August 23, reflected the influence of a heavy rainfall which occurred in the upper reaches of Pumpkinvine Creek the day before. At times during Wednesday and Thursday the Pumpkinvine Creek concentrations ranged from 100 to 300 mg/l and the

24-hour silt load amounted to approximately 50 tons. During the earlier general survey, the Pumpkinvine Creek concentrations were usually below 20 with only a few samples showing 30 mg/1. Since the Pumpkinvine Creek inflow represented only a small percentage of the total Etowah discharge, the increased tributary silt load during this one day did not materially effect the 3-day average suspended sediment load in the Etowah River.

The arithmetic average concentration of the Etowah River silt at Station E-39.0 was 61 mg/1 as compared to the 52 mg/1 observed at the previous upstream sampling station. The 549 tons per day weighted average mass of solids passing this station was almost identical to the 550 tons per day average for the upstream station. Observations at these 2 sampling stations show that the Thompson Weinman Company, located between these 2 points, did not discharge any significant quantity of silt to the river during this study.

At stations farther downstream the peaks were not so sharp or so well defined. During each daily cycle at the last downstream Etowah River Station E-6.4, the concentrations increased to a high level plateau rather than to a sharp peak. Here the concentrations ranged from 20 to 120 mg/1 for an average of 48 mg/1. Waters containing the higher concentration of suspended sediments passed through this reach shortly after midnight. The total suspended sediment load amounted to 329 tons per day. This was approximately 200 tons per day less than the 550 tons per day from the Cartersville area. Undoubtedly a large portion of this difference in measured load passed downstream along the bottom as bed load.

Although the Etowah River bottom was relatively free from sediment deposits, some of these solids may have settled out along the banks and in quiet pools where they remained until resuspended and carried downstream during subsequent extreme peak discharges.

During daylight hours there was no great difference between the appearance of the Etowah and the Oostanaula Rivers at their junction in Rome. Both rivers were light to medium tan colored. The Oostanaula had a grayish-tan cast, usually associated with the erosion of top soil to the river. The Etowah had a distinctive reddish-tan cast, more nearly resembling the color of the underground formations that are mined in the Cartersville area.

Suspended sediment was much more uniform in the Oostanaula River waters entering Rome, Georgia. These concentrations ranged from 40 to 65 mg/l with an average of 55 mg/l. The suspended sediment load amounted to 125 tons per day. It is understood that in previous years the Oostanaula was considerably clearer during this season of the year. During August 1961, for example, the turbidity averaged 30 or approximately 1/2 of the 55 average turbidity units observed during the August 1962 survey. Grading operations on new U. S. Highway 75 near the upper reaches of the Oostanaula River during 1962 may account for part of this year's unseasonably high turbidity in the Oostanaula River.

There were no real distinct peaks or valleys in the suspended solids concentrations in the Coosa River below Rome.

At Station C-275.4, 7 miles below Rome, the concentration ranged from 20 to 130 with an average of 45 mg/l. The total suspended sediment load amounted to 365 tons per day.

At Station C-268.5, 14 miles below Rome and approximately 1 mile above the Rome Kraft waste outfall, the solids concentration range was further reduced to 25 to 45 with an average of 34 mg/l. The total load amounted to 295 tons per day.

At Station C-265.3, about 2 miles below the Rome Kraft outfall, the range of solids concentrations increased to 30 to 70 with an average of 42 mg/l. The total load was 357 tons per day.

Crossing the state line, at Station C-252.8, the solids concentrations ranged from 15 to 50 mg/l with an average of 30 mg/l. The total suspended sediment load was 257 tons per day.

The appearance of the Coosa River below Rome reflected the blending of the reddish and grayish-tan colors of the Etowah and Ooostanaula Rivers. Throughout the August survey there was no distinct difference in the color and appearance of the Coosa River downstream from Rome, across the state line and to Poole's Ferry in Alabama. In the vicinity of Poole's Ferry, and farther down towards Cedar Bluff, more of the fine suspended solids settled out and the color, turbidity and general appearance improved as the waters flowed through Lake Weiss. The lake, though moderately turbid in the upper flowage areas, was very clear from Cedar Bluff to the outlet.

Local fishermen and property owners advised members of the survey team that they had never seen the Coosa River and upper Lake Weiss nearly so clear as it appeared during this August 1962 survey. During the July 1962 preliminary survey the appearance of the Coosa River and upper Lake Weiss was considerably more turbid and dingy than in August. The Etowah River was much more turbid and highly colored, especially during the daylight hours. In fact, during July there was a distinct line of demarkation and contrast between the reddish, muddy-appearing Etowah River and the relatively clear Oostanaula River at their confluence.

During the August survey, the Coosa River and upper Lake Weiss undoubtedly appeared much clearer than during the corresponding season in late August and early September of 1961. The degree of improvement is evident from the summary of August-September Etowah and Oostanaula turbidity data collected by the Rome City Water Department and discussed in a subsequent section of this report.

Variations in Suspended Sediment

The changes in Etowah River suspended solids concentrations were so great that the results of single grab samples could be misleading. For example, a sample collected before 11:00 A.M. from Station E-44.5 could contain less than 1/5 of the average 24-hour silt load. Conversely, a sample collected at 11:30 A.M., at peak flows, would indicate that the river was carrying almost 10 times the actual 24-hour silt load. Similar, but smaller differences could occur in single grab samples collected from the lower reaches of the Etowah River. At Rome, for example, where the range of concentrations had been greatly compressed, a grab sample collected at noon would contain less than 1/2 of the actual 24-hour average solids concentration. If collected about midnight, such a sample could contain more than twice the average concentration. Gross discrepancies of this type were eliminated by sampling at frequent intervals round-the-clock during the special study.

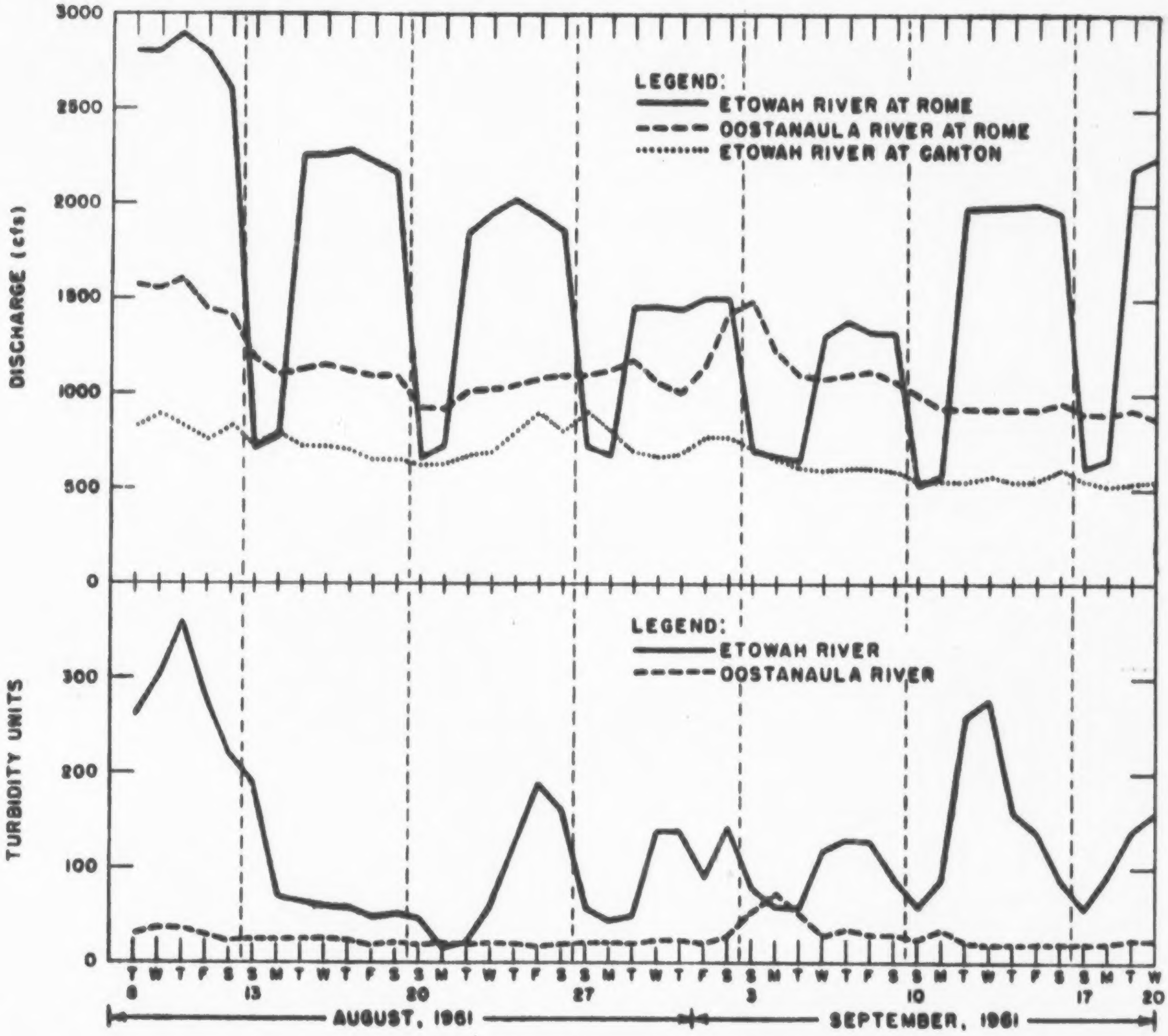
COMPARISON WITH 1961 DATA

From August 8 to September 20, 1961, the Rome City Water Department measured the turbidity of samples collected from the Etowah and Oostanaula rivers between 9:30 to 10:00 A.M. each day. The results of these turbidity tests along with the U.S.G.S. recorded mean daily discharges are plotted on Figure 16. Turbidity concentrations and river discharge figures were combined to calculate the equivalent mass of turbidity in equivalent tons per day as posted in Table A-17. The equivalent mass passing through Rome in each of these 2 rivers is shown in Figure 17. The mean discharge, by months, for the last 10 water years are posted in Table No. A-18.

The general pattern of low turbidities during the early part of the week and high turbidities during the middle or latter part of the week corresponded to the normal weekly operating schedules at the mineral washing installations near Cartersville.

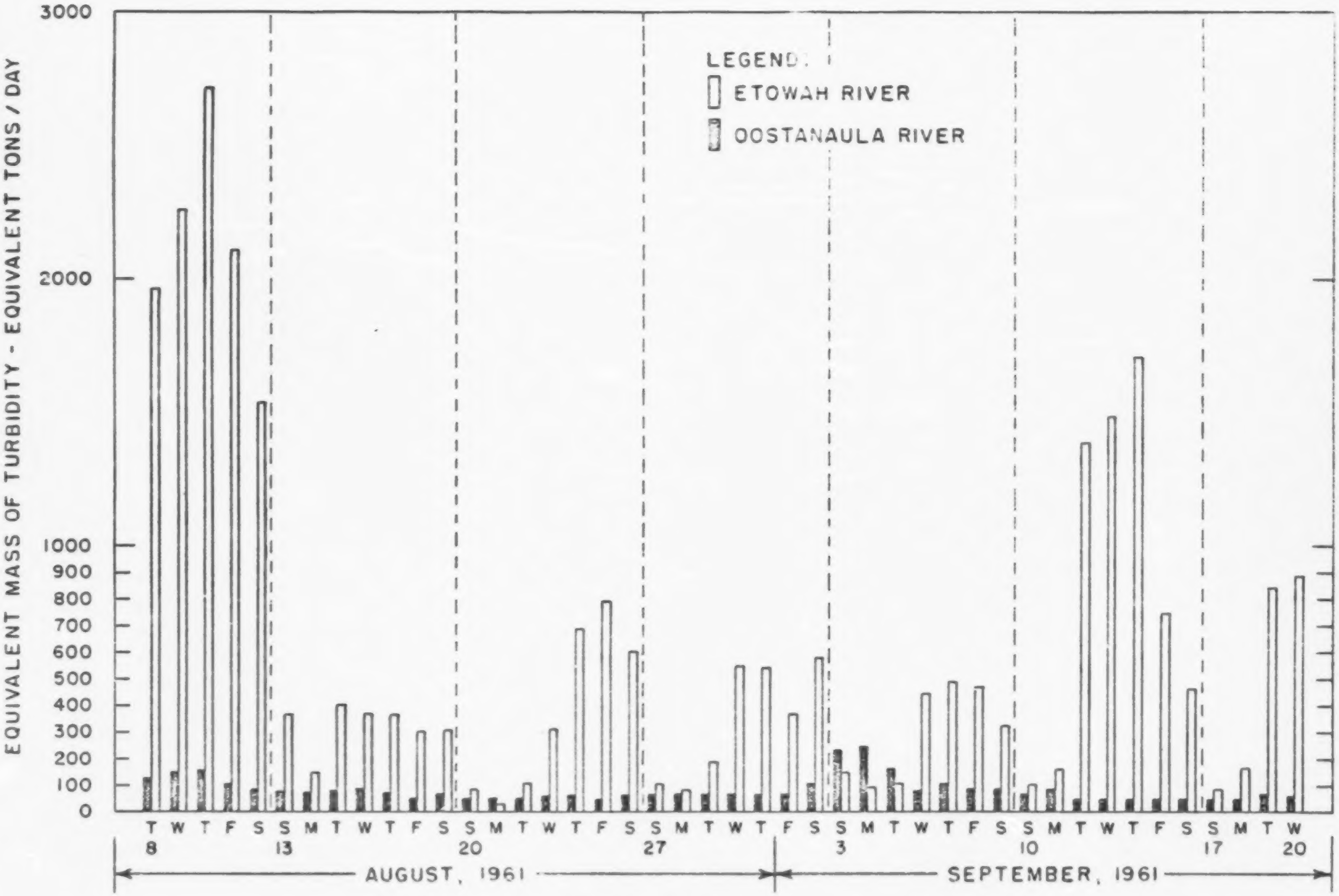
During the middle of the week, the Etowah River turbidity concentrations were 5 to 10 times higher than the turbidity of the Oostanaula River. Furthermore, the equivalent mass of turbidity, flowing through Rome in the Etowah River, was 8 to 30 times that in the Ooostanaula River.

59a



COOSA RIVER SYSTEM, GEORGIA-ALABAMA
OOSTANAULA AND ETOWAH RIVERS AT ROME GEORGIA
DISCHARGE AND TURBIDITY
AUGUST - SEPTEMBER 1961

FIGURE 16



COOSA RIVER SYSTEM, GEORGIA - ALABAMA
OOSTANAULA AND ETOWAH RIVERS AT ROME GEORGIA
TURBIDITY
MASS IN EQUIVALENT TONS PER DAY—AUGUST-SEPTEMBER 1961

Figure A-17

Obviously, the major portion of the suspended sediment load came from the Etowah River above Rome. No known large sources of suspended solids, other than the wastes from the mineral washing operations in the Cartersville area, could account for this great difference between turbidity of the two rivers.

The average Etowah River discharge during August-September 1961 was similar to the discharge during August 1962. The measured turbidity concentrations and the computed equivalent mass of solids moving down the Etowah River during the 1961 season, however, were about 2-1/2 times the August 1962 loadings. Based on the fluctuations revealed by the round-the-clock studies, it is probable that the daily peak Etowah River turbidities in 1961 also entered Rome during the midnight and early morning hours, and the actual total 24-hour loads exceeded the observed values which were based on samples collected between 9:30 and 10:00 A.M. in the morning.

These comparisons indicate that in addition to the New Riverside Ochre Company load, waste solids from other mining operations were discharged to the Etowah River during August and September 1961.

RELEASES FROM ALLATOONA DAM

The Mobile District of the U. S. Army Corps of Engineers maintains complete operating records on the Allatoona Power Dam. These records show that for several years after ~~1955~~ 1950, when the Allatoona project started full operation, the sluice gates were opened briefly (approximately 15 minutes) about once a year to check the operating machinery. This practice was discontinued in 1954, and since that time the sluices have been opened on only 1 occasion. On January 7, 1962, the sluice gates were opened for 5 hours between 2:00 A.M. and 7:00 A.M. to discharge flood waters stored in the reservoir.

The Corps of Engineers surveyed cross sections of the natural terrain above the Allatoona Dam site before the dam was constructed and the area inundated. Resurveys of key ranges in 1949, 1950, 1953, 1958, 1960, and 1961 indicated that sediment deposits in the Allatoona Reservoir were negligible.

The Corps of Engineers collected suspended sediment samples from the Etowah River at approximately monthly intervals from August 1961 through July 1962. The results of tests on these samples, collected during periods of both high and low flows from Stations E-47.0 immediately below Allatoona Dam to Station E-21.4 at U. S. Highway 411 near Kingston, Georgia, are posted on Table A-19. The individual test results from these samples cover a wide range of stream conditions. The samples collected below Allatoona Dam, which is above all sources of mineral washing wastes, provides a year-round picture of the unpolluted upstream Etowah River waters. The suspended sediment content of 16 samples collected at this point averaged 11 mg/l. The extremes varied from a low of 1 mg/l to a single day maximum of 46.2 mg/l. The solids concentration in 15 of the 16 samples was below 20 mg/l.

The negligible amount of silt deposited in Allatoona Reservoir proper, the fact that the sluice gates were opened for only a few hours in the years since 1950, and the consistently low turbidity immediately below the dam show that the Etowah River silt problem is not caused by releases from Allatoona Dam.

ROAD BANK EROSION

Research on erosion from road banks is conducted by the Coosa Watershed Project of the Agricultural Research Service in Cartersville. Their studies to date show that the annual soil loss from 6 plots has varied from a minimum of 25 tons per acre to a maximum of 359 tons per acre. The extent of erosion varies according to orientation, slope, type of soil, intensity of precipitation and other factors. Frost action and bank orientation had been 2 of the principal contributors to the erosion process on the unprotected road cuts. Planting 30 species of ground cover on 850 experimental road bank plots proved that adaptive plants on properly fertilized areas can develop an effective cover which will control bank erosion.

Lacking data on the total acreage of unprotected road banks, it was not possible to estimate the proportionate soil loss entering the rivers from this source. Road bank erosion control work continues to increase on major highways in the area, but there is very little control on minor roads. The road banks on most major highways and all new Federal highways, including new Interstate 75 under construction parallel to U. S. Highway 41 from Dalton to Cartersville, are or will be seeded for erosion control.

Control of road banks has received increasing attention in recent years and it is expected that these control efforts will be further expanded in the future. Such a program will continue to reduce the amount of sediment reaching the rivers from these sources.

SOIL EROSION

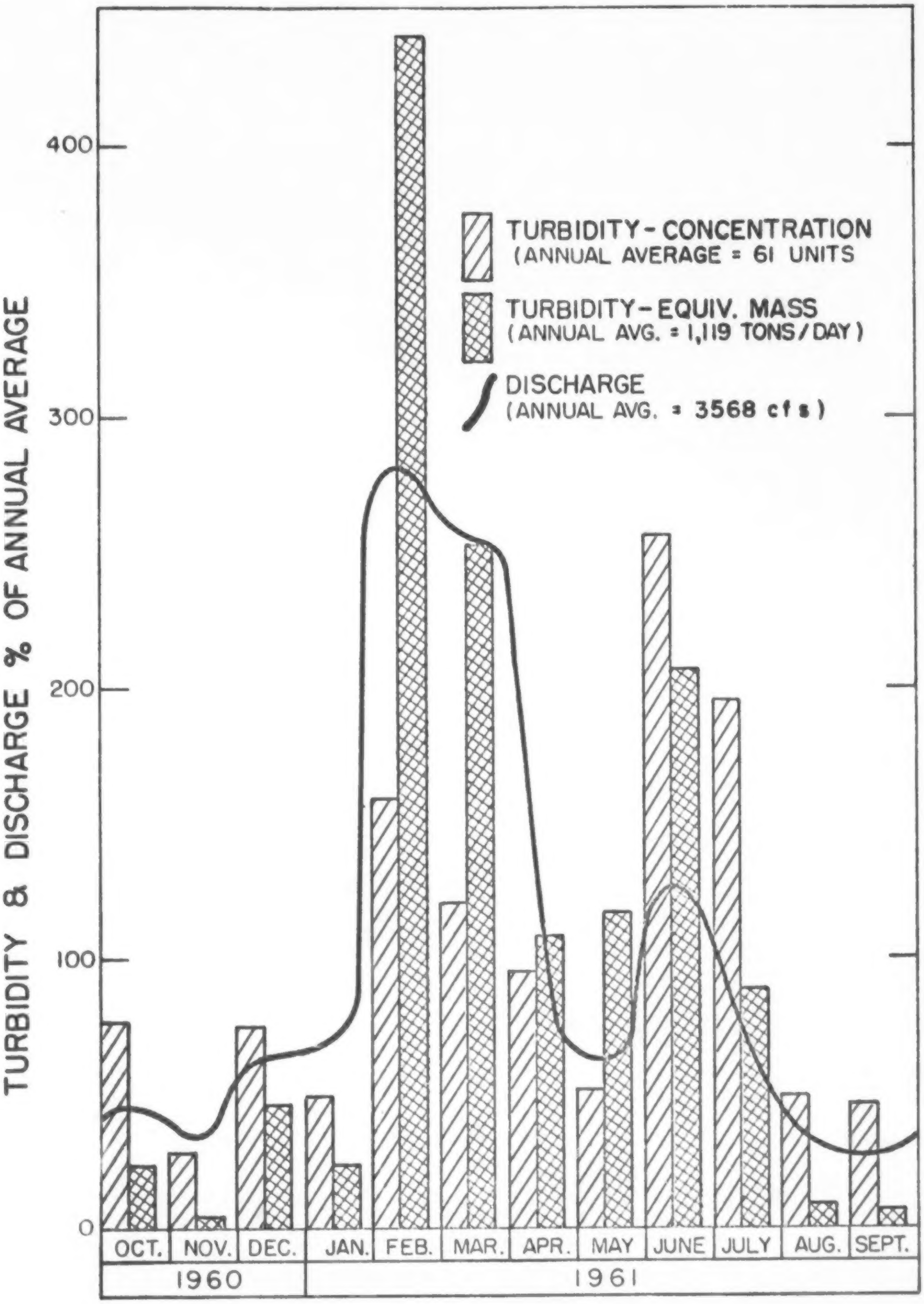
Introduction

Turbidity and the total sediment load of the Etowah and Coosa Rivers is related to normal soil erosion as well as the man-made discharge of solids into this river system. Research studies, field findings, and general information provided by the many cooperating agencies previously listed were correlated to determine the probable amounts of eroded soil reaching the Etowah River. These studies show that erosion is not directly related to the total rainfall nor the total runoff. It does, however, respond almost directly to the frequency of excessive-rate rainfalls which precipitate 1/2 inch or more of rain in 30 minutes.

Monthly Variation of Turbidity Due to Soil Erosion

Daily discharge and turbidity records of the Oostanaula River at Rome were evaluated to determine the monthly variations of natural turbidity during the 1960-1961 water year. The results of this analysis are shown in Tables A-20 through A-22 and Figures A-1 through A-4 and summarized on Figure No. 18.

The maximum monthly average concentration of turbidity occurred in June. The 156 unit monthly average was 256 per cent of the 61 unit annual average.



OOSTANAULA RIVER AT ROME, GEORGIA

TURBIDITY & DISCHARGE

PERCENT OF ANNUAL AVERAGE

FIGURE [illegible]

The maximum monthly average mass of turbidity occurred in February. The 4,927 equivalent ton per day monthly average was 440 per cent of the 1,119 ton per day annual average.

The minimum monthly average concentration occurred in September. The 28 unit monthly average was 46 per cent annual average.

The minimum monthly average mass of turbidity also occurred in September. The 81 equivalent ton per day average was 7 per cent of the annual average.

The August turbidities were only slightly higher than the September minimums. During August the 30 unit concentration was 49 per cent and the 103 ton per day mass was 9 per cent of the respective annual averages.

Annual Soil Erosion Loss to Etowah River

From observations at selected test plots, the Soil Conservation Service estimated the soil loss and delivery to the streams for various types of land use in the Etowah River watershed between Allatoona Dam and Rome. Estimated annual soil losses for this area are posted in Table No. 4. The summary shows that approximately 230,000 tons of soil per year reached the Etowah River between Allatoona Dam and Rome. This amounts to an annual average loss of 630 tons per day.

Soil Erosion Rates During Specific Months of the Year

According to the previous water year study, maximum soil loss usually occurs during the month of February. The average soil erosion loss to the Etowah River between Allatoona Dam and Rome in February approximates 440 per cent of the annual average, or 2,772 tons per day.

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

ESTIMATED SOIL EROSION DELIVERY TO THE ETOWAH RIVER

TABLE NO. 4

(Calculated from Estimated Sediment Rates Provided by Soil Conservation Service State Office, Athens, Georgia)

WATERSHED NUMBER	LAND USE			SOIL LOSS		DELIVERY	
	Type	%	Acres	Tons/ Acre/ Year	Tons/ Year (X1000)	Rate %	To Stream Tons/Year
ETOWAH RIVER (Between Allatoona Dam and Rome, Ga.)							
13	Cultivated	5.9	5,673	23.5	133		
	Pasture	6.5	6,250	5.5	34		
	Forest	72.9	70,101	4.5	315		
	Idle & Misc.	14.7	14,136	14.5	205		
	Total	100.0	96,160	7.14*	687	8.2	56,000
14	Cultivated	7.6	2,601	25.5	66		
	Pasture	6.5	2,225	6.2	14		
	Forest	83.6	28,614	7.1	203		
	Idle & Misc.	2.3	787	15.3	12		
		100.0	34,227	8.62*	295	11.3	33,000
15	Cultivated	25.7	33,863	11.0	372		
	Pasture	5.9	7,774	4.0	31		
	Forest	63.3	83,407	2.0	167		
	Idle & Misc.	5.1	6,720	15.0	101		
		100.0	131,764	5.10*	671	7.2	48,000
16	Cultivated	15.0	17,986	13.5	243		
	Pasture	20.0	23,982	5.3	127		
	Forest	60.0	71,946	4.3	309		
	Idle & Misc.	5.0	5,996	14.5	87		
		100.0	119,910	6.39*	766	7.7	59,000
34	Cultivated	22.7	18,278	10.5	192		
	Pasture	6.2	4,992	4.0	20		
	Forest	65.4	52,659	2.0	105		
	Idle & Misc.	5.7	4,589	15.0	69		
		100.0	80,518	4.79*	386	8.7	34,000
TOTAL			462,579		2,805		230,000

* Average

13 = Pumkinvine Creek Watershed

14 = Raccoon Creek Watershed

15 = Several small streams draining south into the Etowah

16 = Euharlee Creek Watershed

34 = Several small streams draining north into the Etowah above the junction with the Oostanaula River

During the June period of peak concentration, the loss approximates 207 per cent of the annual average, or 1,304 tons per day.

During the low rainfall period of August, however, only 9 per cent of the annual average, or approximately 57 tons per day of soil from natural erosion reached the Etowah River between Allatoona Dam and Rome.

August Soil Erosion Loss vs. Mineral Washing Waste Solids

Distribution of the 57 tons per day of soil erosion from the 5 sub-watersheds and the 494 tons per day of waste solids from the New Riverside Ochre Company plant is illustrated on Figure 19.

Based on a 5-day workweek, the estimated annual 128,500 ton silt discharge from the New Riverside Ochre Company amounts to 56 per cent of the total soil erosion load. During August, however, the estimated waste solids load was more than 8-1/2 times the total soil erosion loss to the river.

TOTAL SUSPENDED SOLIDS LOADINGS

The sources of suspended sediment loadings introduced into the Etowah and Coosa Rivers during the August survey are posted in Table No.5 and shown on Figure 20.

This figure shows that in the Cartersville area 56 tons per day were contained in the waters discharged from Allatoona Dam. Twenty-four and three-tenths tons per day of soil erosions solids entered via Pumpkinvine Creek. Some 7-1/2 tons per day of organic solids and erosion was carried by Pettit Creek, and it was estimated that approximately 1 ton entered through the City of Cartersville's Etowah River outfall sewer.

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COOSA RIVER SYSTEM - GEORGIA-ALABAMA

TOTAL SUSPENDED SOLIDS LOADING

TABLE NO. 5

SOURCE	TOTAL SOLIDS Tons/Day
Allatoona Lake (E-8)	56
New Riverside Ochre (NR-1)	494
Thompson Weinman (TW-1)	0.14
Cartersville (Sewage Est.)	1.0
Pumpkinvine Creek (PU-1)	24.3
Pettit Creek (PE-1)	7.5
Silver Creek (SI-1)	8.0
Oostanaula River (O-1)	125
Rome (Sewage Est.)	4.0
Rome Kraft (Ind. Waste Est.)	15
Big Cedar Creek (BC-1)	5.0

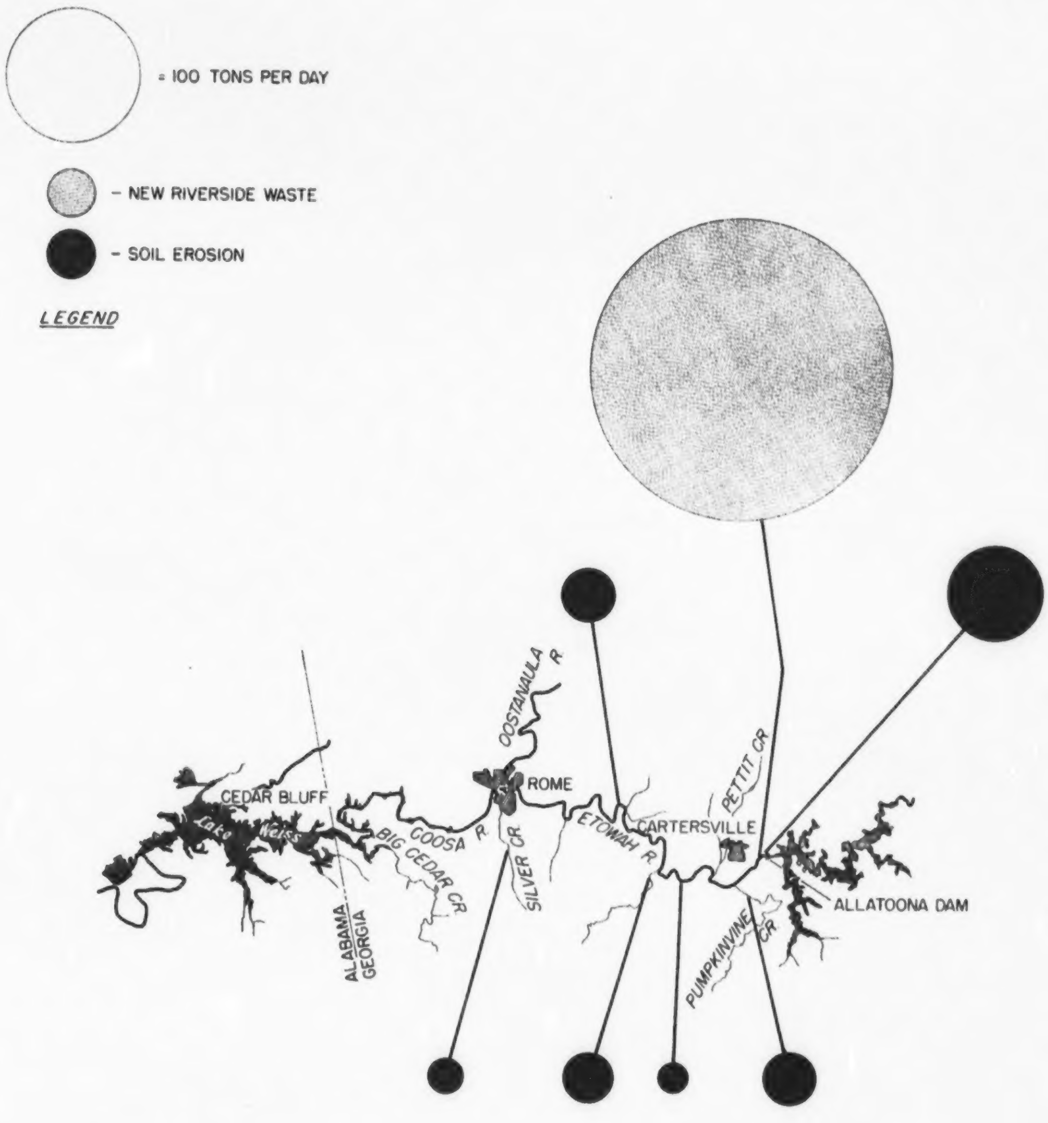
COOSA RIVER SYSTEM, GEORGIA - ALABAMA

ETOWAH, OOSTANAULA AND COOSA RIVERS

SUSPENDED SEDIMENT LOAD COMPARISON

AUGUST 1962

FIGURE 19


= 100 TONS PER DAY
- NEW RIVERSIDE WASTE
- SOIL EROSION
LEGEND
OOSTANAULA R
ROME
CEDAR BLUFF
Lake Weiss
COOSA R
BIG CEDAR CR
SILVER CR
ETOWAH R
CARTERSVILLE
PETTIT CR
ALLATOONA DAM
PUMPKINVINE CR
ALABAMA
GEORGIA

65c

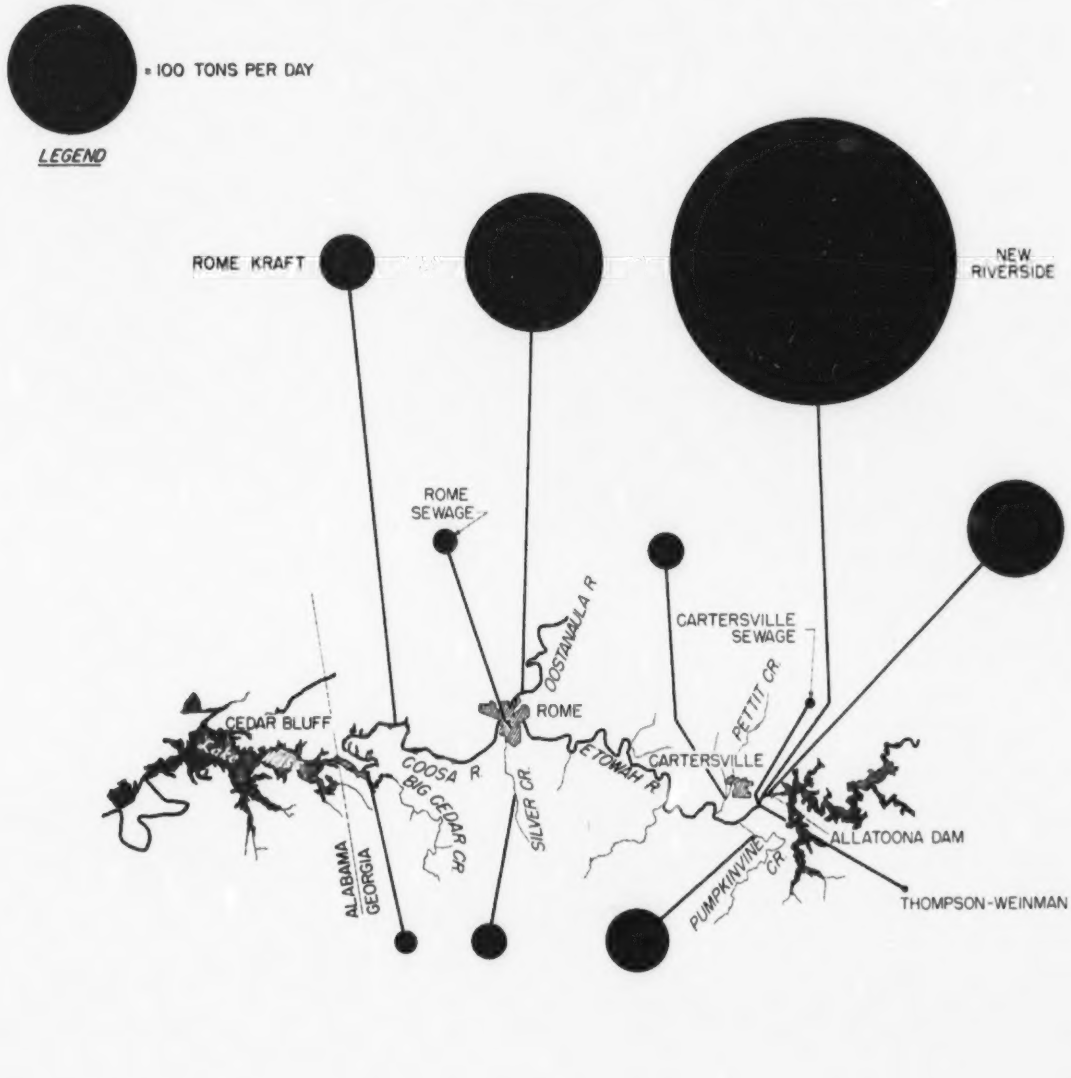
COOSA RIVER SYSTEM, GEORGIA-ALABAMA

ETOWAH, OOSTANAULA AND COOSA RIVERS

TOTAL SUSPENDED SOLIDS LOADING

AUGUST 1962

FIGURE 20



● = 100 TONS PER DAY
LEGEND
ROME KRAFT
NEW RIVERSIDE
ROME SEWAGE
CARTERSVILLE SEWAGE
OOSTANAULA R
ROME
CEDAR BLUFF
PETTIT CR.
CARTERSVILLE
COOSA R
BIG CEDAR CR
SILVER CR.
ETOWAH R
ALLATOONA DAM
ALABAMA
GEORGIA
PUMPKINVINE CR
THOMPSON-WEINMAN

During the August survey, only 0.14 of 1 ton per day was discharged from the Thompson Weinman waste holding ponds. The majority of the solids entering the river in this area, amounting to 494 tons per day, were discharged by the New Riverside Ochre Company.

In the vicinity of Rome, approximately 8 tons per day were carried by Silver Creek, and it is estimated that approximately 4 tons per day of organic solids were contained in the raw domestic sewage. Approximately 125 tons per day of solids were carried by the Oostanaula River.

Below Rome approximately 15 tons per day of solids were contained in the Rome Kraft waste discharges, and another 5 tons per day entered the Coosa River from Big Cedar Creek.

PER CENT OF TOTAL SUSPENDED SEDIMENT LOAD ATTRIBUTABLE TO NEW RIVERSIDE OCHRE COMPANY WASTE DISCHARGES

Figure 21 shows the relative effect of the New Riverside Ochre Company waste discharges on river water quality in the Etowah and Coosa Rivers.

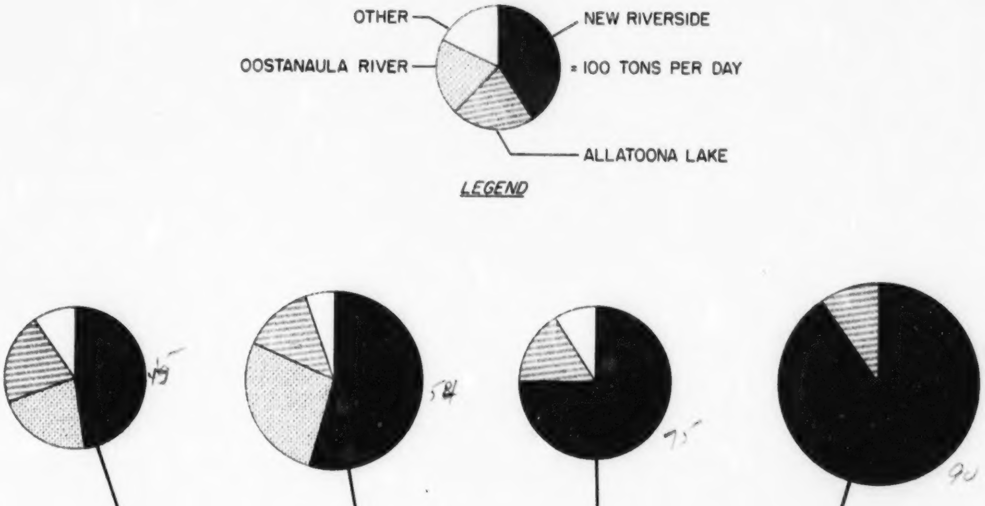
Above Cartersville, 10.4 per cent of the total solids content of the Etowah River were discharged through Allatoona Dam. The other 89.6 per cent were discharged by the New Riverside Ochre Company.

At the mouth in Rome, the Etowah River contained 329 tons per day, or 221 tons less than the original 550 tons per day at Cartersville. It is assumed that the total 56 tons per day from Allatoona Lake, which had been subjected to long-term storage and settling, flowed undiminished all the way down the Etowah and the Coosa Rivers. Based on this assumption, 66-a

COOSA RIVER SYSTEM, GEORGIA-ALABAMA
ETOWAH, OOSTANAULA AND COOSA RIVERS
SOURCES OF SUSPENDED SEDIMENT

AUGUST 1962

FIGURE 21



OTHER
NEW RIVERSIDE
OOSTANAULA RIVER
= 100 TONS PER DAY
ALLATOONA LAKE
LEGEND
45
58
75
90
OOSTANAULA R
PETTIT CR
CEDAR BLUFF
ROME
Lake Weiss
COOSA R
BIG CEDAR CR
SILVER CR
ETOWAH R
CARTERSVILLE
ALLATOONA DAM
PUMPKINVINE CR

the solids from Allatoona Lake represented 17 per cent of the total, and natural soil erosion contributed 8.5 per cent. The remaining 74.5 per cent of the solids in the Etowah River at Rome came from New Riverside Ochre Company.

The sum of the Etowah and Oostanaula rivers sediment loads amounted to 454 tons per day. Of this, 12.3 per cent came from Allatoona Lake, 6 per cent from soil erosion to the Etowah River, and 27.7 per cent from the Oostanaula River. The remaining 54 per cent came from New Riverside Ochre Company.

At the state line, the total suspended sediment loading approximated 257 tons per day. Assuming that the total 56 tons from Allatoona Reservoir persisted to this point, 23 per cent of the load came from the Oostanaula River, 22 per cent from the Allatoona Reservoir, and 10 per cent from other sources. The other sources include Big Cedar Creek, the residual from the Rome Kraft wastes, and soil erosion to the Etowah River. The remaining 45 per cent of the total sediment load crossing the state line during August is attributable to waste discharged by the New Riverside Ochre Company.

This study revealed that during August almost 1/2 of the turbidity and suspended solids of the Coosa River at the state line and in upper Lake Weiss were discharged to the Etowah River by the New Riverside Ochre Company in Cartersville.

Turbidity data furnished by the Rome, Georgia City Water Department indicates that during August and September 1961 considerably more than half of the turbidity in the Coosa River at, and below the state line, originated from mineral waste discharges into the Etowah River.

These unnatural off-color mineral waste suspensions degrade the physical appearance, reduce the aesthetic appeal, and interfere with full enjoyment of the recreation potential of the Coosa River and upper Lake Weiss.

SUMMARY AND CONCLUSIONS

A. Scope of Surveys, Discussions, Summaries, and Conclusions

1. The August 1962 stream surveys were conducted primarily to evaluate interstate pollution of the Coosa River System.
2. Local pollution problems requiring correction also were observed during the course of this study. These intrastate problems are under investigation by the Georgia Department of Public Health, which has direct responsibility for controlling pollution of waters in the State of Georgia.
3. The observed local intrastate effects of pollution were recorded and discussed in the body of this report. Except where they relate to interstate pollution, these local effects are not included in the following summaries and conclusions.

B. Chattooga River - Organic and Bacterial Pollution

1. Chattooga River waters were contaminated by raw sewage discharges from the communities of Trion and Summerville, Georgia.
2. The amount of contamination in the Chattooga River near the state line, as shown by the August 1962 coliform bacterial concentrations, is summarized as follows:
   a. Two miles above the state line the coliform content ranged

   from 1,700 to 22,000 for an average of 7,400 MPN/100 ml.

   b. Three miles below the state line the coliform content ranged from 800 to 35,000 for an average of 6,000 MPN/100 ml.

3. Contamination entering the river in Georgia increased the coliform bacterial content of the Chattooga River in Georgia and Alabama to levels considered unsatisfactory for water-contact recreation.

4. Chattooga River waters were polluted by sewage and industrial wastes from Trion and Summerville, particularly from the Riegel Textile plant in Trion.

5. This pollution reduced the dissolved oxygen concentration of the Chattooga River to zero near Summerville.

6. Approximately one-half of the samples collected 2 miles above and 9 2 miles below the state line contained less than the 4.0 mg/1 minimum dissolved oxygen required of the Alabama Water Improvement Commission.

7. Dye wastes from the Riegel Textile plant produced unnatural, aesthetically offensive off-color blues, blacks and greens in the Georgia reach of the Chattooga River.

8. Pollution discharged to the Chattooga River in Georgia has killed fish in Georgia and Alabama. One major fish kill occurred in November 1961 and another in June 1962. Pollution remains a major threat to fish life in the Chattooga River.

C. Coosa River - Organic and Bacterial Pollution

1. Coosa River waters were contaminated by raw sewage discharges from Rome, Georgia.
2. The amount of contamination in the Coosa River near the state line, as shown by the August 1962 coliform bacterial concentration, is summarized as follows:
    a. Four miles above the state line, the coliform content ranged from 900 to 24,000 for an average of 6,400 MPN/100 ml.
    b. At the state line, the coliform content ranged from 1,300 to 10,900 for an average of 3,500 MPN/100 ml.
    c. Five miles below the state line the coliform content ranged from 700 to 13,000 for an average of 2,400 MPN/100 ml.
3. Contamination entering the river in Georgia increased the coliform bacterial content of the Coosa River in Georgia and Alabama to levels considered unsatisfactory for water-contact recreation.
4. The Coosa River and tributaries were polluted by sewage and industrial wastes from the Pepperell Manufacturing Company at Lindale, Rome and associated industries, and particularly by the Rome Kraft paper mill west of Rome.
5. Pollution reduced the dissolved oxygen concentration of the Coosa River at the state line to a minimum of 1.9 mg/l.
6. Approximately one-third of the samples collected at the state line and one-half of the samples collected at stations 1-1/2 and 5 miles below the state line contained less than the 4.0 mg/l

minimum dissolved oxygen standard of the Alabama Water Improvement Commission.

7. Pollution of the Coosa River during August 1962 periodically reduced the water quality and the fish and aquatic life environment to critical levels above, at, and below the Georgia-Alabama State Line.

D. Silt Pollution

1. The Etowah and Coosa Rivers were polluted by silt and clay from mineral washing waste discharges.
2. During the August 1962 survey period, the turbidity and suspended sediment load of the Etowah River at Rome, Georgia, were considerably reduced below the levels experienced during the previous August and September 1961 season.
3. Results of the August 1962 special round-the-clock suspended sediment load studies are summarized as follows:
   a. Mineral washing wastes from the Thompson Weinman Paga Mines were settled in waste holding ponds. These ponds were supervised diligently during the survey period and the solids removal efficiencies were excellent. The effluent contained 0.14 tons of solids per day. This illustrates that mineral washing waste pollution can be effectively eliminated by adequately sized and properly operated waste settling ponds.

   Additional Control Standards not required

   b. Mineral washing wastes from the New Riverside Ochre Company plant were collected in a small waste holding pond and then

[illegible]

sluiced to the Etowah River at the end of each workday. These wastes contained approximately 500 tons of solids per day.

c. Waste solids, discharged by the New Riverside Ochre Company, formed 90 per cent of the Etowah River suspended sediment load at Cartersville and 45 per cent of the Coosa River load at the Georgia-Alabama State Line.

4. Silt deposits over the river bottom in upper Lake Weiss reach a maximum observed depth of 10-1/2 inches 5 miles below the state line.

5. The bottom organism and algae, normally serving as fish food, were seriously degraded by the silt load in the Etowah and Coosa Rivers.

6. The unnatural off-color mineral waste suspensions degraded the physical appearance, reduced the aesthetic appeal and interfered with full enjoyment of the recreation potential of the Coosa River and upper Lake Weiss.

E. Conclusions

1. Wastes entering the Chattooga River from Trion, the Riegel Textile Corporation of Trion, and Summerville and associated industries, and wastes entering the Coosa River and tributaries from the New Riverside Ochre Company of Cartersville, the Pepperell Manufacturing Company of Lindale, Rome and associated industries, and Rome Kraft Company in Georgia endangers the health and welfare of persons in Alabama.

2. This pollution of interstate waters is subject to abatement under the Federal Water Pollution Control Act.

APPENDIX

TABLES A-1 to A-22

FIGURES A-1 to A-4

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

LOCATION GUIDE

TABLE NO. A-1

Sampling Station and Reference Point Locations

STATION NO.	RIVER MILEAGE	DESCRIPTION
CHATTOOGA RIVER (Including Lake Weiss)		
CH-9	CH-48.85	Chattooga River bridge, 3 miles above, and N. W. of Trion.
CH-8B	CH-45.85	Chattooga River bridge, 0.1 miles above Riegel Mills in Trion.
R-1	CHR-45.75	Riegel Textile Corp. outfall by old U.S. No. 27 in Trion.
CH-8A	CH-44.65	Chattooga River bridge, 1.0 miles below Trion on U.S. No. 27. (South side of river channel).
CH-8	CH-42.4	Chattooga River bridge below Trion and 5/8 mile E. of U.S. No. 27.
CH-7	CH-39.6	Chattooga River near Summerville, north City limits.
CH-6	CH-37.8	Chattooga River bridge on U.S. No. 27, 1 mile above the Summerville outfall.
-	CH-37.7	U.S.G.S. gaging Station 2-3980.
-	CH-36.85	Summerville sewer outfall.
CH-5	CH-34.8	Chattooga River bridge on Holland Road below the Summerville outfall, 1 mile E. of Georgia No. 114.
RC-1	CHRC-32.8-1.0	Raccoon Creek bridge on Georgia No. 114 near Berryton.
CH-4	CH-28.8	Chattooga River bridge on S2201, 0.5 miles S. of Lyerly and 0.75 miles from Georgia No. 114.

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

LOCATION GUIDE

TABLE NO. A-1

Sampling Station and Reference Point Locations
(continued)

STATION NO.	RIVER MILEAGE	DESCRIPTION
CHATTOOGA RIVER (Including Lake Weiss) - Continued		
CH-3 =1-CH	CH-23.6	Chattooga River bridge on S1363, 2 miles above the State Line and 0.75 miles S. of Chattoogaville and Georgia No. 114.
-	CH-21.6	GEORGIA-ALABAMA STATE LINE.
CH-2 =2-CH	CH-18.4	Chattooga River bridge, 3 river miles below the State Line, and 0.3 miles S.E. of Alabama No. 68. ALSO U.S.G.S. GAGING STATION 2-3983.
CH-1 =3-CH	CH-12.4	Chattooga River, Gaylesville area, bridge on Alabama No. 35.
4-CH	CH- 8.9	Chattooga River bridge on Alabama No. 68, N. of Cedar Bluff.
5-CH	CH- 5.5	Chattooga River, N.E. of Cedar Bluff.
ETOWAH RIVER		
E-9	E-77.97	Etowah River, Canton area, bridge on Georgia No. 5. ALSO U.S.G.S. GAGING STATION 2-3920.
-	E-48.0	Allatoona Dam.
E-8	E-47.3	Etowah River, 0.7 miles below Allatoona Dam.
-	E-47.0	U.S.G.S. GAGING STATION 2-3940.

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

LOCATION GUIDE

TABLE NO. A-1

Sampling Station and Reference Point Locations
(continued)

STATION NO.	RIVER MILEAGE	DESCRIPTION
ETOWAH RIVER - Continued		
NR-1	ENR-46.3	New Riverside Ochre Company outfall.
E-7	E-44.5	Etowah River bridge on Georgia No. 3, N.W. of Emerson.
-	E-40.8	CARTERSVILLE SEWER OUTFALL AND SEWER FROM CHEMICAL PRODUCTS CORPORATION.
TW-1	ETW-40.8	Thompson Weinman Company outfall.
PU-1	EPU-40.2-1.0	Pumpkinvine Creek bridge W. of Emerson. (Below Haney-Mosteller waste pond).
PU-2	EPU-40.2-4.0	Pumpkinvine Creek bridge S. of Emerson. (Above Haney-Mosteller waste pond).
E-6	E-39.0	Etowah River bridge S. of Cartersville.
-	E-38.2	U.S.G.S. GAGING STATION.
PE-1	EPE-37.0-1.0	Pettit Creek bridge on Georgia No. 61, S.W. of Cartersville. (Below Cartersville City sanitary sewers).
E-5	E-30.4	Etowah River, Euharlee area, bridge, 1 mile from S831.
EU-1	EEU-29.9-0.5	Euharlee Creek bridge, S.E. of Euharlee.
E-4	E-26.2	Etowah River bridge on S829, 2 miles S. of new U.S. No. 411.
E-3	E-21.4	Etowah River bridge on new U.S. No. 411, S.W. of Kingston. ALSO U.S.G.S. GAGING STATION.

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

LOCATION GUIDE

TABLE NO. A-1

Sampling Station and Reference Point Locations (continued)

STATION NO.	RIVER MILEAGE	DESCRIPTION
ETOWAH RIVER - Continued		
TR-1	ETR-20.4-1.0	Two Run Creek bridge, S.W. of Kingston.
CO-1	ECO-20.1-1.5	Connesena Creek bridge, S.W. of Kingston.
SP-1	ESP-19.9-0.5	Spring Creek bridge on new U.S. No. 411.
E-2	E- 6.4	Etowah River at Freeman's Ferry, 2 miles from new U.S. No. 411.
S1-1	ES1- 0.4-2.2	Silver Creek bridge below Lindale.
E-1	E- 0.14	Etowah River at Broad Street bridge in Rome, Georgia.
-	E- 2.0	U.S.G.S. GAGING STATION 2-3960.
-	E- 0.0 =C-282.4 =0-0.0	Confluence of Etowah, Oostanaula, and Coosa Rivers in Rome, Georgia.
OOSTANAULA RIVER		
0-1	0-1.3	Oostanaula River, Rome area upstream, Rome water works intake.
-	0-4.6	U.S.G.S. GAGING STATION 2-3885.
COOSA RIVER (Including Lake Weiss)		
-	C-279.3	ROME CITY SEWER OUTFALL.

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

LOCATION GUIDE

TABLE NO. A-1

Sampling Station and Reference Point Locations
(continued)

STATION NO.	RIVER MILEAGE	DESCRIPTION
COOSA RIVER (Including Lake Weiss) - Continued		
C-1	C-278.4	Coosa River, Rome area downstream at county work camp.
C-2	C-275.4	Coosa River, Rome area downstream at Mayo's Bar Lock and Dam.
C-3	C-268.5	Coosa River, 1 mile above Rome Kraft waste outfall diffuser.
-	CRK-267.4	Rome Kraft diffuser.
C-4	C-265.3	Coosa River, 2 miles below Rome Kraft waste outfall diffuser.
C-5	C-260.7	Coosa River at Morton Bend, 7 miles below Rome Kraft.
C-6	C-256.0	Coosa River, 3 miles above the State Line.
BC-1	CBC-255.8-0.3	Big Cedar Creek.
BC-2	CBC-255.8-6.5	Big Cedar Creek bridge on S1367.
-	CBC-255.8-20.0	U.S.G.S. GAGING STATION 2-3975.
-	C-252.9	GEORGIA-ALABAMA STATE LINE.
C-7 =-C	C-252.8	Coosa River, 0.15 miles below the State Line.
2-C	C-251.3	Coosa River approximately 1.6 miles below the State Line.
3-C	C-249.6	Coosa River approximately 3.3 miles below the State Line.

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

LOCATION GUIDE

TABLE NO. A-1

Sampling Station and Reference Point Locations (continued)

STATION NO.	RIVER MILEAGE	DESCRIPTION
COOSA RIVER (Including Lake Weiss) - Continued		
C-8 =4-C	C-247.9	Coosa River at Poole's Ferry, approximately 5 miles below the State Line.
5-C	C-246.4	Coosa River approximately 6.5 miles below the State Line.
6-C	C-243.6	Coosa River approximately 9.3 miles below the State Line.
7-C	C-240.1	Coosa River, S. of Cedar Bluff, approximately 12.8 miles below the State Line.
8-C	C-236.1	Coosa River bridge on Alabama No. 9 at Cedar Bluff.
9-C	C-234.0	Coosa River approximately 2.0 miles W. of Cedar Bluff near confluence of old Chattooga and Coosa River channels.
10-C	C-231.0	Coosa River approximately 21.9 miles below the State Line.
1-LR	LR- 3.9	Little River arm of Lake Weiss.

NOTE: Stations in Lake Weiss are referenced according to river miles along the old river channels.

TABLE NO. A-2

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

RIVER CONDITIONS FOR AUGUST 2 - AUGUST 30, 1962

Including Paper Mill Production and B.O.D. Loads to the River

Data Provided by Rome Kraft Company of Rome, Georgia

River Survey Day	River Survey Date	Mill Production (Tons)	B.O.D. To River (#/Day)	River Flow (cfs)			D.O.'s at the Various Mile Points (Miles below Rome, Ga.)																	
				Avg.	High	Low	14	15½	16.2	19	21	23	25	26	27[a]	28	29	30	31[b]	32	33	34	35	36[c]
T	8/2/62	1371.06	51,800	2551	3590	1740	6.7	6.6	6.6	4.7	4.1	4.8	5.1	5.3	3.6	3.5	4.1	4.2	5.3	6.5	7.5	7.1	7.3	8.0
F	3	1128.92	34,800	2517	3590	1600	6.9	7.5	7.0	4.0	3.5	5.0	4.6	3.9	2.8	2.8	3.5	4.3	4.6	5.2	5.7	5.7	6.3	5.3
S	4	1261.05	39,100	1904	2990	1600	6.8	7.3	7.3	4.0	3.6	4.5	3.9	2.5	2.6	3.2	3.6	4.4	5.1	4.4	4.3	4.2	3.8	4.1
Sunday	5	1293.62	40,400	1517	1600	1475	7.4	4.8	6.3	5.9	5.6	6.0	2.9	2.9	3.5	5.0	5.4	6.0	5.7	5.4	6.9	6.9	6.5	8.9
M	6	1249.13	37,900	2427	4600	1475	6.5	5.2	6.2	6.2	6.7	6.4	5.8	6.2	6.2	6.2	7.3	7.4	7.5	7.5	6.5	7.0	8.5	8.3
T	7	1353.91	59,700	3533	4990	2090	6.7	6.8	6.4	5.0	3.5	3.6	4.6	4.6	4.0	3.6	3.5	5.0	7.5	8.2	7.5	7.7	7.8	8.0
W	8	1326.07	34,800	3755	5120	2480	7.0	7.1	6.4	6.1	4.3	3.8	4.1	4.4	4.3	4.2	4.0	3.4	3.2	3.2	4.0	3.8	4.5	4.7
T	9	1303.73	46,400	4041	5400	2750	6.5	7.0	6.3	6.1	5.5	4.2	4.2	4.5	4.7	4.7	5.1	4.9	4.2	3.7	3.9	4.1	4.2	6.3
F	10	1349.58	51,800	3852	5120	2480	6.2	6.4	6.2	6.3	5.7	4.9	4.2	5.9	4.7	5.0	5.0	5.3	4.9	4.8	5.3	5.6	6.3	6.3
S	11	1370.74	44,600	2659	4600	1600	6.3	7.1	6.7	6.6	5.5	4.9	4.5	4.4	4.7	5.0	5.0	5.1	4.7	4.4	4.5	4.1	4.5	7.1
Sunday	12	1426.12	26,800	1543	1600	1475	6.9	6.9	7.0	6.4	4.5	5.0	5.2	5.8	5.6	4.6	4.9	4.8	4.6	4.9	5.0	6.5	6.7	7.9
M	13	1367.86	48,100	2664	5540	1370	5.9	5.3	5.7	6.1	5.9	6.5	5.4	6.8	5.0	6.7	7.6	7.7	7.3	6.6	7.0	7.6	6.2	6.4
T	14	1289.98	70,900	3704	5680	1970	5.8	5.9	5.5	5.0	2.7	2.0	3.1	3.5	3.8	4.0	4.1	4.0	4.0	4.3	5.2	5.0	4.7	7.9
W	15	1259.40	73,200	3758	5680	1970	6.1	5.8	5.7	5.6	4.2	2.3	2.7	3.6	3.9	4.3	4.2	3.8	3.8	2.7	-	-	-	-
T	16	1307.75	55,500	3664	5540	1740	5.8	6.5	5.8	6.0	4.7	3.0	3.5	3.9	4.0	4.0	4.1	4.0	3.2	2.5	2.1	2.8	2.7	6.0
F	17 A.M.	1263.54	56,500	3625	5540	1740	5.9	5.9	5.6	5.8	4.8	3.9	3.7	3.9	4.1	4.2	4.5	4.2	3.5	3.2	3.0	3.1	4.0	4.8
F	17 P.M.	-	-	-	-	-	6.9	6.3	5.9	5.5	5.3	4.8	4.5	3.9	3.8	4.3	4.4	4.6	4.4	5.9	5.5	5.3	5.1	5.0
S	18	1166.04	30,200	2416	4860	1370	5.7	6.0	5.6	5.8	4.7	4.1	3.5	3.7	4.0	4.2	4.5	4.0	4.2	4.0	4.1	4.1	4.0	7.7
Sunday	19	1486.75	9,400	1299	1370	1270	6.8	5.3	6.5	6.1	4.5	4.5	4.6	4.6	4.4	3.6	5.0	4.3	4.8	5.6	5.7	7.9	6.7	8.4
M	20	1331.43	17,200	1990	4080	1270	6.0	5.1	5.6	5.5	6.2	6.3	6.2	5.7	5.5	5.6	7.6	7.7	8.0	7.7	8.1	8.5	8.5	8.0
T	21	1535.27	42,700	2749	4080	1475	6.4	6.5	6.0	5.6	4.8	4.2	4.7	4.5	4.7	4.3	4.6	5.2	6.0	7.4	8.3	8.4	8.2	7.7
W	22	1380.07	32,500	2838	4470	1600	6.5	6.8	6.7	5.5	4.0	4.5	3.7	3.6	3.4	3.0	3.1	3.7	4.2	4.4	4.6	4.8	5.0	5.7
T	23	1411.94	33,600	3008	4340	1740	6.7	7.0	6.8	5.0	3.8	4.8	5.5	5.0	4.5	3.8	3.8	3.8	4.4	4.4	4.3	4.1	3.9	4.5
F	24	1377.57	31,100	2754	4210	1475	6.7	6.6	6.6	6.1	4.0	4.7	5.3	5.2	4.5	3.6	3.6	3.3	3.9	4.6	4.6	3.9	3.5	3.7
S	25	1436.60	9,000	1924	3710	1270	6.3	6.9	6.9	5.3	4.1	5.0	5.4	5.3	4.5	3.7	3.6	4.0	4.5	5.0	4.6	3.9	3.8	4.1
Sunday	26	1336.72	35,900	1270	1270	1270	7.2	5.1	6.3	6.0	5.7	5.8	4.0	4.3	4.4	5.0	5.6	5.8	6.6	6.6	-	-	-	7.1
M	27	1049.48	28,200	1756	3840	1270	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T	28	681.28	39,900	2379	3710	1270	6.2	6.0	5.7	4.5	4.5	4.2	4.7	4.8	4.7	5.2	5.5	6.7	7.5	6.8	7.4	9.6	8.2	9.0
W	29	1149.52	56,700	2430	3710	1270	6.9	7.1	6.7	5.1	3.8	4.5	5.4	4.7	4.8	4.7	5.3	6.1	7.3	8.3	8.6	8.7	9.7	10.1
T	30	1383.95	37,000	2341	3710	1170	7.3	7.0	6.6	4.4	3.8	5.2	4.1	3.7	3.6	3.5	4.8	4.4	4.7	5.2	5.4	6.6	5.9	7.0
MAXIMUM		1535.27	73,200	4041	5680	2750	7.4	7.5	7.3	6.6	6.7	6.5	6.2	6.8	6.2	6.7	7.6	7.7	8.0	8.3	8.6	9.6	9.7	10.1
MINIMUM		681.28	9,000	1270	1270	1170	5.7	4.8	5.6	4.0	2.7	2.0	2.7	2.5	2.6	2.8	3.1	3.3	3.2	2.5	2.1	2.8	2.7	3.7
AVERAGE		1298.24	40,500	2651	4088	1630	6.5	6.3	6.3	5.5	4.6	4.6	4.5	4.5	4.2	4.3	4.7	4.9	5.2	5.3	5.5	5.8	5.8	6.7

a. Above Big Cedar Creek
b. At State Line
c. At Poole's Ferry

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

CHATTOOGA RIVER

TABLE NO. A-3

Summary PHS Survey Data - August 1962

River Mile		Temp. °C	pH	B.O.D. mg/1	D.O. mg/1	% Sat.	Coliform MPN/100 ml	Color
MAIN STEM								
CH-48.85	Max.	26	7.6	2.7	8.3	101	24,000	25
	Min.	21	6.8	0.7	5.3	62	2,200	10
	Avg.	23	7.1	2.1	6.6	77	7,856	15.1
CH-45.85	Max.	24	7.6	4.1	9.4	108	17,000	15
	Min.	20	6.8	1.1	8.2	92	2,100	9
	Avg.	22	7.2	2.2	8.6	97	5,032	11.1
CH-44.65	Max.	26	10.0	49.2	6.7	82	92,000	80
	Min.	22	9.3	30.5	4.0	46	2,100	30
	Avg.	23	9.7	38.6	4.9	57	19,001	56.8
CH-42.4	Max.	25	10.0	36.5	5.2	58	54,200	50
	Min.	21	6.8	3.2	1.5	18	130	9
	Avg.	22	9.0	20.2	2.4	28	11,736	32.6
CH-39.6	Max.	27	9.8	32.2	5.9	67	240,000	50
	Min.	22	7.9	1.8	0.0	0	330	11
	Avg.	26	9.0	17.8	1.1	12	9,288	29.3
CH-37.8	Max.	26	9.5	34.7	6.0	69	240,000	95
	Min.	22	6.8	2.5	0.0	0	130	10
	Avg.	24	8.9	17.8	1.0	12	20,422	34.4
CH-34.8	Max.	27	9.6	21.0	6.7	77	2,400,000	40
	Min.	21	7.0	2.7	0.0	0	11,000	11
	Avg.	23	8.7	11.6	1.3	16	184,833	24.4
CH-28.8	Max.	27	9.2	9.8	6.3	73	24,000	29
	Min.	22	6.7	2.3	0.7	26	230	11
	Avg.	24	8.2	5.8	3.2	36	5,658	19.1
CH-23.6	Max.	26	8.9	7.7	5.6	65	22,000	30
	Min.	22	6.6	2.8	2.0	23	1,700	13
	Avg.	24	8.0	4.9	3.4	40	7,444	18.9
CH-18.4	Max.	27	8.4	8.4	6.2	70	34,800	20
	Min.	22	6.8	1.6	3.6	44	790	11
	Avg.	24	7.8	3.0	4.5	54	5,970	16.4
CH-12.4	Max.	28	8.1	10.8	9.0	110	4,900	22
	Min.	23	7.2	2.1	2.6	30	330	9
	Avg.	25	7.6	3.5	5.1	62	1,812	14.6
TRIBUTARY								
CHRC-32.8-1.0	Max.	24	8.2	1.6	9.3	106	54,200	20
	Min.	20	6.8	0.6	6.0	85	3,300	6
	Avg.	22	7.3	1.2	8.4	96	12,100	9.4
INDUSTRIAL WASTE								
CHR-45.75	Max.	30	11.4	>565	10.0	115	92,000	700
	Min.	20	6.0	324	0.0	0	20	160
	Avg.	26	10.2	-	-	-	-	-

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

CHATTOOGA RIVER

TABLE NO. A-4

Summary Alabama Survey Data - August 1962

River Mile		Temp. °C	pH	B.O.D. mg/1	D.O. mg/1	% Sat.	Turb. Units
	MAIN STEM						
CH-23.6	Max.	26	9.2	6.7	7.8	95	24
	Min.	24	7.4	1.2	1.7	20	8
	Avg.	25	8.6	3.2	4.2	50	17
CH-18.4	Max.	26	9.1	5.4	8.2	98	65
	Min.	23	7.4	0.5	3.1	37	15
	Avg.	25	8.4	2.3	4.7	56	23
CH-12.4	Max.	31	8.9	6.5	8.4	100	85
	Min.	24	7.6	1.1	2.1	26	15
	Avg.	26	8.4	2.2	4.1	49	27
CH-8.9	Max.	31	8.5	5.6	9.5	127	25
	Min.	28	7.2	1.2	2.3	30	13
	Avg.	29	8.1	3.2	7.0	90	21
CH-5.5	Max.	30	8.3	4.2	9.9	112	18
	Min.	28	7.6	1.3	5.7	72	8
	Avg.	29	7.8	2.5	7.3	91	13

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

ETOWAH RIVER

TABLE NO. A-5

Summary PHS General Survey Data - August 1962

River Mile		Temp. °C	pH	B.O.D. mg/1	D.O. mg/1	% Sat.	Coliform MPN/100 ml	Turb.	Color
MAIN STEM									
E-47.3	Max.	23	6.6	3.8	2.0	23	1,300	14	45
	Min.	21	6.4	3.5	1.6	18	790	6	7
	Avg.	21.8	6.4	3.6	1.7	20	1,045	11	25
E-44.5	Max.	24.5	6.8	-	3.4	40	-	330	20
	Min.	21	6.3	-	2.3	28	-	10	8
	Avg.	22	6.5	2.0	2.8	33	1,090	125	15
E-39.0	Max.	23.5	7.2	7.0	6.4	73	4,900	365	23
	Min.	21	6.6	4.2	5.1	59	3,100	6	12
	Avg.	22.3	6.8	5.6	5.7	66	4,000	106	17
E-30.4	Max.	25.5	7.2	3.6	7.3	83	13,000	30	28
	Min.	21.5	7.0	1.7	6.3	71	12,000	10	13
	Avg.	22.5	7.1	2.7	6.7	77	12,500	14	19
E-26.2	Max.	25	7.4	2.6	8.1	95	3,300	32	25
	Min.	21.8	7.0	2.2	6.8	77	3,100	7	10
	Avg.	22.7	7.3	2.4	7.4	85	3,200	15	17
E-21.4	Max.	25.5	8.2	4.0	8.9	95	9,400	26	30
	Min.	21	7.0	2.8	7.0	78	2,200	7	11
	Avg.	22.8	7.3	3.4	7.8	88	5,800	16	20
E-6.4	Max.	26	7.5	5.7	9.8	117	17,200	56	30
	Min.	21.5	6.8	1.4	7.3	85	490	9	11
	Avg.	24	7.2	3.9	8.0	94	7,298	24	24
TRIBUTARIES									
EPU-40.2-1.0	Max.	24.5	7.4	2.0	8.2	95	10,900	36	30
	Min.	21.5	7.1	1.4	7.6	88	4,900	8	14
	Avg.	23.2	7.2	1.7	7.9	92	7,900	18	17
EPU-40.2-4.0	Max.	26	7.4	-	7.7	92	-	29	30
	Min.	22	7.0	-	7.6	89	-	9	15
	Avg.	24	7.2	-	7.6	90	-	14	19
EPE-37.0-1.0	Max.	24	7.5	23.0	5.1	58	10,900,000	460	75
	Min.	21.5	7.2	20.7	4.2	49	700,000	12	11
	Avg.	22.8	7.4	21.9	4.6	54	5,800,000	85	37
EEU-29.9-0.5	Max.	21.5	7.8	2.2	7.8	88	33,000	126	27
	Min.	20	7.3	1.6	7.6	83	7,000	11	8
	Avg.	20.9	7.5	1.9	7.7	85	20,000	30	11
ETR-20.4-1.0	Max.	22	7.9	-	-	-	-	38	15
	Min.	21.5	7.8	-	-	-	-	16	12
	Avg.	21.6	7.8	-	-	-	-	27	14
ECO-20.1-1.5	Max.	24	7.8	-	8.8	96	-	250	27
	Min.	20	7.4	-	8.6	96	-	6	6
	Avg.	20.9	7.5	-	8.7	96	-	38	10
ESP-19.9-0.5	Max.	22.5	8.2	-	8.8	100	-	17	14
	Min.	20	7.4	-	8.2	90	-	4	6
	Avg.	20.9	7.6	1.0	8.5	95	3,300	8	9
ESI-0.4-2.2	Max.	28.5	7.8	14.1	4.8	60	490,000	61	35
	Min.	21.5	6.9	4.3	0.7	8	31,000	9	8
	Avg.	26	7.5	9.1	2.7	33	124,357	16	16
MINERAL WASHING POND DISCHARGES									
ENR-46.3	Max.	24.5	-	-	-	-	-	26,000	12
	Min.	21.5	-	-	-	-	-	2,850	9
	Avg.	22.5	6.9	-	-	-	-	8,862	10
ETW-40.8	Max.	34	7.0	-	-	-	-	105	75
	Min.	27	6.2	-	-	-	-	4	4
	Avg.	29.9	6.5	-	-	-	-	27	17
ETW-40.8	Max.	31	6.8	-	-	-	-	325	250
	Min.	25	6.1	-	-	-	-	30	10
	Avg.	27.6	6.6	-	-	-	-	107	78

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

COOSA RIVER

TABLE NO. A 6

Summary PHS General Survey Data - August 1962

River Mile		Temp. °C	pH	B.O.D. mg/l	D.O. mg/l	% Sat.	Coliform MPN/100 ml	Turb.	Color
HEAD WATERS									
E-6.4	Max.	26	7.5	5.7	9.8	117	17,200	56	30
	Min.	21.5	6.8	1.4	7.3	85	490	9	11
	Avg.	24	7.2	3.9	8.0	94	7,298	24	24
ESI-0.4-2.2	Max.	28.5	7.8	14.1	4.8	60	490,000	61	35
	Min.	21.5	6.9	4.3	0.7	8	31,000	9	8
	Avg.	26	7.5	9.1	2.7	33	124,357	16	16
0-1.3	Max.	28.5	7.3	2.8	7.4	87	54,000	86	32
	Min.	22.5	7.1	1.3	6.1	71	2,200	54	9
	Avg.	24.9	7.3	2.0	6.4	77	11,079	71	18
MAIN STEM									
C-278.4	Max.	24.5	7.4	3.5	7.3	83	700,000	65	40
	Min.	21	6.9	1.5	6.3	72	33,000	29	13
	Avg.	23	7.2	2.5	6.7	77	149,250	43	24
C-275.4	Max.	25	7.3	4.2	7.6	87	230,000	75	30
	Min.	21.5	6.9	1.3	6.4	73	22,000	33	13
	Avg.	23	7.1	2.4	6.9	80	99,000	49	24
C-268.5	Max.	25	7.5	4.7	7.4	88	350,000	57	32
	Min.	23	6.6	1.3	6.0	70	17,200	38	15
	Avg.	23.9	7.1	2.4	6.6	77	111,700	46	22
C-265.3	Max.	26	7.3	7.0	6.6	78	130,000	65	45
	Min.	23	6.8	2.9	4.9	53	4,900	39	24
	Avg.	24.8	7.0	4.0	5.3	69	49,154	51	35
C-260.7	Max.	27.5	7.2	3.7	5.9	72	33,000	63	46
	Min.	23	6.8	1.2	3.9	52	4,900	43	21
	Avg.	25	7.0	2.5	5.3	63	21,715	50	33
C-256.0	Max.	26	7.3	3.0	5.1	61	24,000	70	43
	Min.	23	6.0	1.0	1.8	22	940	30	24
	Avg.	25.1	7.0	1.8	3.6	44	6,405	50	35
C-252.8	Max.	27	7.3	3.4	6.2	60	10,900	52	39
	Min.	24	6.3	1.0	1.9	23	1,300	24	24
	Avg.	25.7	6.9	1.8	3.7	45	3,494	39	32
C-247.9	Max.	27	7.2	3.1	4.8	60	13,000	58	43
	Min.	25	6.1	1.2	3.0	37	700	26	25
	Avg.	25.8	7.0	2.1	3.6	45	2,377	41	34
TRIBUTARIES									
CBC-255.8-0.3	Max.	28	7.2	4.0	7.5	95	3,300	112	35
	Min.	25	6.0	1.6	2.9	35	490	31	23
	Avg.	25.9	6.9	2.2	4.2	52	1,630	54	32
CBC-255.8-6.5	Max.	23	7.4	4.2	8.5	96	54,200	28	17
	Min.	20.5	6.2	1.0	7.8	86	3,300	8	10
	Avg.	21.7	7.0	2.3	8.2	92	1,688	14	14

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

COOSA RIVER

TABLE NO. A-7

Summary Alabama Survey Data - August 1962

River Mile		Temp. °C	pH	B.O.D. mg/1	D.O. mg/1	% Sat.	Turb. Units
	MAIN STEM						
C-252.8	Max.	31	7.9	4.2	10.2	134	48
	Min.	26	7.0	0.4	1.9	24	25
	Avg.	28	7.3	1.8	4.6	54	32
C-251.3	Max.	30	7.5	3.7	6.0	79	39
	Min.	27	6.9	0.4	1.9	24	21
	Avg.	28	7.2	1.8	4.3	54	30
C-249.6	Max.	30	7.5	4.9	8.9	117	47
	Min.	27	7.0	0.8	2.6	33	19
	Avg.	28	7.2	2.0	4.7	59	31
C-247.9	Max.	30	7.8	4.9	9.5	124	45
	Min.	27	7.0	0.1	3.0	38	17
	Avg.	28	7.3	1.9	5.1	64	30
C-246.4	Max.	31	7.9	5.9	10.1	135	40
	Min.	27	7.1	0.1	3.5	44	20
	Avg.	28	7.4	2.3	5.8	74	29
C-243.6	Max.	30	7.7	4.5	8.4	108	29
	Min.	27	7.1	0.0	2.8	35	20
	Avg.	28	7.4	2.1	6.0	76	25
C-240.1	Max.	29	8.2	3.2	8.1	104	27
	Min.	27	7.1	0.5	3.3	42	13
	Avg.	28	7.4	2.0	6.0	76	21
C-236.1	Max.	31	7.9	4.0	9.4	121	27
	Min.	27	7.2	0.4	5.0	63	12
	Avg.	29	7.6	2.0	7.1	90	19
C-234.0	Max.	31	8.0	4.0	9.8	131	23
	Min.	28	7.1	0.6	4.7	59	10
	Avg.	29	7.5	2.0	6.9	89	15
C-231.0	Max.	30	8.3	3.9	9.7	129	26
	Min.	28	7.5	1.1	5.6	71	9
	Avg.	28	7.8	2.3	7.6	96	13
	TRIBUTARY						
LR-3.9	Max.	31	8.4	3.8	10.0	133	19
	Min.	27	7.1	1.7	6.4	81	10
	Avg.	29	7.8	2.7	7.9	101	15

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

ALGAL COUNTS IN NUMBER PER ML.

TABLE NO. A-8

River Miles	Day of Week	Time	Algal Genera*	Number per ml. Flagellate Algae	Green Algae	Blue-Green Algae	Diatoms	Total
				ETOWAH RIVER				
329.6	Sat.	10:15 AM	5		147	380	168	653
303.8	Sat.	11:30 AM	2	42	42		42	126
288.8	Wed.	9:00 AM	0				422	422
				OOSTANAULA RIVER (282.4)				
1.3	Wed.	11:00 AM	10	295	1,730	168	3,882	6,075
				COOSA RIVER				
278.5	Wed.	2:00 PM	8	126	653		1,857	2,636
265.3	Thur.	9:30 AM	2		41	41	456	538
252.8	Thur.	1:40 PM	12	337	1,646	780	2,026	4,789
247.9	Fri.	4:00 PM	9	94	476		539	1,109
239.4	Fri.	1:45 PM	9	641	538		7,204	8,383

* Excluding Diatoms

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

DEPTH (inches) OF REMAINING INCIDENT LIGHT

TABLE NO. A-9

River Miles	Day of Week	Time	% of Remaining Light 25%	10%	5%	2.5%	1%
ETOWAH RIVER							
E-47.3	SAT.	10:15 AM	23	60[1]	86[2]	115[2]	151[2]
E- 6.4	WED.	9:00 AM	4	10	15	20	26
OOSTANAULA RIVER							
1.3	WED.	11:00 AM	11	19	24	30	37
COOSA RIVER							
278.5	WED.	2:00 PM	5	12	17	23	30
265.3	THURS.	9:30 AM	6	13	18	24	31
252.8	THURS.	1:40 PM	10	19	28	37	48
247.9	FRI.	4:00 PM	6[3]	16	23	30	39
239.4	FRI.	1:45 PM	12	26	38	49	65
CHATTOOGA RIVER							
CH-10	FRI.	11:00 AM	10	22	31	41	53

1. Bottom
2. Theoretical Calculation
3. Strong Wind

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

PRE-IMPOUNDMENT FISH POPULATION SUMMARY[1]

TABLE NO. A-10

	Coosa River				Chattooga River	
	Above Sewell Ferry (7-18-58)		Below Sewell Ferry (7-18-58)		4 Mi. Below Georgia Line (10-29-58)	
	No.	E*	No.	E	No.	E
Blue Catfish, Over 12"	6					
Blue Catfish, Under 12"	3	9.3	3	0.1		
Channel Catfish, Over 10"	6		21		2	1.0
Channel Catfish, Under 10"	20	15.0	40	10.5		
Flathead Catfish, Over 12"			13		24	
Flathead Catfish, Under 12"	7	.2	6	8.1	8	22.6
Spotted Bass, Over 9"			8		24	
Spotted Bass, Under 9"	1	.4	6	3.6	18	23.9
Redeye Bass, Over 9"					8	
Redeye Bass, Under 9"					30	6.5
N. Rock Bass, Over 5"					18	
N. Rock Bass, Under 5"					12	3.9
Bluegill, Over 5"					14	
Bluegill, Under 5"			1		4	2.2
Yellowbelly Sunfish, Over 5"			2	0.2	14	
Yellowbelly Sunfish, Under 5"					28	1.5
Black Crappie, Over 8"			2	0.4		
Walleye, Over 11"			1	0.8		
Green Sunfish			1			
Spotted Suckers			2	1.5	14	1.8
Hog Suckers					20	1.0
River Redhorse	3	24.3	17	22.8		
Golden Redhorse					66	27.0
Blacktail Redhorse	19	30.0	97	32.8	18	7.7
Drum			11	6.8		
Buffalo			1	6.3		

PRE-IMPOUNDMENT FISH POPULATION SUMMARY[1]
(Continued)

TABLE No. A-10

	Coosa River				Chattooga River	
	Above Sewell Ferry (7-18-58)		Below Sewell Ferry (7-18-58)		4 Mi. Below Georgia Line (10-29-58)	
	No.	E*	No.	E	No.	E
Mooneye	41	15.9	18	1.7		
Gizzard Shad	15	3.2	15	3.3		
Carp Sucker			1			
Others	178	1.6	56		72	0.9

SUMMARY

	Above Sewell Ferry	Below Sewell Ferry	4 Mi. Below Georgia Line
Number of Fish Per Acre	299	322	376
Pounds of Fish Per Acre	56.0	227.2	147.2
% Adult Fish by Weight	74.9	89.3	80.7
% Adult Usable Fish (Food and Game)	21.3	20.0	55.0
% Game Species	0.4	5.0	38.2

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[1] Annual Report, October 1, 1957 - September 30, 1958, Dept. of Conservation, State of Alabama, pp. 124, 134, 136, and 137, and a Detailed Fish and Wildlife Conservation and Recreation Plan for Weiss Dam and Reservoir Project (FPC 2146) Coosa River, Alabama prepared for the Alabama Power Company by the Fish and Wildlife Service. (Rotenone Sample)

* The E value of a species or group is the percentage of weight of the entire population composed of that species or group.

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

ELECTROFISHING SURVEY, 1962
(One Hour Duration)

TABLE NO. A-11

	Oostanaula R. Above Rome	Coosa R. Below Rome	Coosa R. Below State Line
Flathead Catfish Over 12"			1
Flathead Catfish Under 12"	1		
Spotted Bass Over 9"	2	2	3
Largemouth Bass Over 10"	3	3	4
Largemouth Bass Under 10"	3	1	3
Bluegill Over 5"	4	2	2
Bluegill Under 5"	2		
Black Crappie Under 8"		1	
Yellowbelly Sunfish Under 5"		2	
Green Sunfish Under 5"			2
Redhorse	2	4	
Buffalo	1	3	3
Carp	5	13	13
Black Bullhead	2		1
Shad		4	15
Golden Shiner		1	
	25	36	47

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

RESULTS OF CORE SAMPLING OF BOTTOM SEDIMENTS

TABLE NO. A-12

Mileage	Location of Core	Depth of Red Silt Layer (inches)
ETOWAH RIVER		
E-44.5	Right Side*	7
E- 6.4	Left Side	3
E- 0.1	Left Side	1/4
COOSA RIVER		
278.5	Left Side	1/4
278.5	Right Side	3/8
275.4	Left Side	3/8
268.5	Left Side	7-1/2
265.3	Right Side	9
247.9	Center	10-1/2
246.9	Center	4
245.9	Center	3

* Facing Downstream

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

BARIUM IN MINERAL WASTES AND IN RIVER BOTTOM SEDIMENTS

TABLE NO. A-13

Core Sample Location	Mileage	Barium, mg/g (dry weight)
New Riverside Sludge Pond		10.8
New Riverside Outfall Ditch into Etowah River		3.6
Etowah River	E-44.5	7.0
Etowah River	E- 6.4	2.6
Coosa River	275.4	1.7
Coosa River	268.5	2.1
Coosa River	265.3	1.6
Coosa River	247.9	4.7
Coosa River	245.9	2.2
Oostanaula River		0.0
Pumpkinvine Creek		0.0

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

RIVER DISCHARGE RECORDS

TABLE NO. A 14

SAMPLE STATION	RIVER MILE	U.S.G.S. IDENTIFICATION NO.	U.S.G.S. IDENTIFICATION LOCATION	DISCHARGE (cfs) AUGUST 1962 DATA: INSTANTANEOUS RATE DURING SPECIAL SURVEY MAX.	INSTANTANEOUS RATE DURING SPECIAL SURVEY MIN.	MEAN DAILY DISCHARGE MAX.	MEAN DAILY DISCHARGE MIN.	MEAN DAILY DISCHARGE AVG.	LONG TERM AVERAGE YEARS	LONG TERM AVERAGE DISCHARGE
	ETOWAH RIVER									
E-9	E-78.0	2-3920	At Canton, Georgia	-	-	710	426	535	34	1,163
E-8	E-47.3	2-3940	At Allatoona Dam	7,250	280	2,610	264	1,476	23	1,677
E-7	E-44.5	-	-	7,280	140	-	-	-	-	-
E-6	E-39.0	-	-	6,600	274	-	-	-	-	-
E-3	E-21.4	-	-	5,300	500	2,820	562	1,741	-	-
E-2	E- 6.4	2-3960	At Rome, Georgia	4,940	616	2,860	640	1,808	39	2,803
	ETOWAH TRIBUTARIES									
PU-1	EPU-40.2-1.0		(Pumpkinvine Creek)	178	32	-	-	-	-	-
PE-1	EPE-37.0-1.0		(Pettit Creek)	12.0	5.5	-	-	-	-	-
EU-1	EEU-29.9-0.5		(Euharlee Creek)	-	-	-	-	-	-	-
SI-1	ESI- 0.4-2.2		(Silver Creek)	51.0	32.0	-	-	-	-	-
	OOSTANAULA RIVER AND TRIBUTARIES									
-	-	2-3870	Conasauga River at Tilton, Georgia	-	-	493	104	192	24	1,148
-	-	2-3835	Coosawattee River at Pine Chapel, Georgia	-	-	1,210	339	557	23	1,396
-	-	2-3875	Oostanaula River at Resaca, Georgia	-	-	1,480	505	789	69	2,745
O-1	O-1.3	2-3885	Oostanaula River near Rome, Georgia	1,190	239	1,520	660	910	22	3,411
	COOSA RIVER									
C-2	C-275.4		Mayo's Dam	4,820	1,160	-	-	-	-	-
-	-	2-3975	Cedar Creek at Cedartown, Georgia	-	-	80	47	61	19	150
	CHATTOOGA RIVER									
CH-6	CH-37.8	2-3980	At Summerville, Georgia	-	-	126	80	94	24	337
CH-1	CH-12.4	2-3983	Gaylesville, Alabama	-	-	219	150	174	3	-

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

SUSPENDED SEDIMENT LOAD

TABLE NO. A-15

Etowah River: From Cartersville to Rome, Georgia
Plus Oostanaula and Coosa Rivers at Rome, Georgia

DAY	DATE	DISCHARGE (cfs)			TOTAL SUSPENDED SOLIDS						FIXED SUSPENDED SOLIDS						PERCENT FIXED %	TURBIDITY (Units)		
		Avg.	Max.	Min.	CONCENTRATION (mg/1)			MASS (Tons/Day)			CONCENTRATION (mg/1)			MASS (Tons/Day)				CONCENTRATION		
					Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.		Avg.	Max.	Min.
STATION E-8					**Below Allatoona Dam - Above All Mineral Wash Water Discharges**													RM	E-47.3	
TUES.	8-21-62	1,730	7,100	290	12.5	15	10	56	[illegible]	47	7.5	10	5	35	47	23	60	8.3	10	5
WED.	8-22-62	1,660	7,250	290	11.7	15	10	52	67	45	5	10	0	22	45	0	42	13.3	15	10
THURS.	8-23-62	1,650	7,380	290	13.3	15	10	59	67	44	8.3	10	5	37	44	22	63	10.7	12	8
NO. OF SAMPLES					8						8							9		
3-DAY AVG.		1680			12.5			56			6.9			31			55	10.8		
STATION E-7					**Below New Riverside Ochre Co. - Above Thompson Weinman Co.**													RM	E-44.5	
TUES.	8-21-62	2,169	7,100	290	41	630	5	413	10,886	4	30	540	0	324	9,330	0	78	46	620	8
WED.	8-22-62	2,092	7,200	290	48	675	5	432	8,122	4	37	620	0	368	8,035	0	85	46	625	9
THURS.	8-23-62	2,108	7,280	140	67	900	10	806	14,447	9	49	805	0	655	12,678	0	81	38	455	10
NO. OF SAMPLES					120						120							60		
3-DAY AVG.		2123			52			550			39			449			81	43		
STATION E-6					**Below All Mineral Wash Water Discharges - Also Below Cartersville & Pumpkin Vine Creek**													RM	E-39.0	
TUES.	8-21-62	2,192	6,460	310	51	390	10	528	6,371	5	36	255	0	390	4,165	0	74	46	457	10
WED.	8-22-62	2,654	6,610	310	64	750	10	572	11,563	8	46	620	0	429	9,559	0	75	64	450	10
THURS.	8-23-62	2,335	6,400	274	69	470	15	548	7,233	15	52	420	10	458	6,464	10	84	70	465	13
NO. OF SAMPLES					123						123							59		
3-DAY AVG.		2393			61			549			45			426			78	60		
STATION E-3					**20 Miles Below Cartersville Area**													RM	E-21.4	
TUES.	8-21-62	1,900	5,080	500	47	260	10	387	2,597	15	34	225	5	307	2,247	7	79	50	190	10
WED.	8-22-62	2,030	5,320	680	57	150	15	448	1,600	30	43	120	6	340	1,279	12	76	39	155	8
THURS.	8-23-62	2,010	5,240	650	69	175	20	522	1,881	35	55	145	15	418	1,558	26	80	59	175	16
NO. OF SAMPLES					38						38							17		
3-DAY AVG.		1980			58			452			44			355			78	49		
STATION E-2					**35 Miles Below Cartersville Area - 6 Miles Above Confluence With Etowah River in Rome, Ga.**													RM	E-6.4	
TUES.	8-21-62	2,100	4,640	683	41	110	20	251	576	56	28	95	10	186	448	28	74	31	44	9
WED.	8-22-62	2,180	4,740	857	41	70	20	288	757	56	30	60	10	215	567	38	75	35	49	21
THURS.	8-23-62	2,240	4,940	748	59	110	25	401	1,370	52	44	90	15	308	1,121	31	77	52	100	26
FRI.	8-24-62	2,120	4,840	711	52	120	25	376	1,437	67	38	100	15	289	1,230	45	77	44	95	28
NO. OF SAMPLES					55						55							24		
4-DAY AVG.		2160			48			329			35			250			76	40		
STATION O-1					**1.3 Miles Above Confluence With Etowah River In Rome, Ga.**													RM	O-1.3	
TUES.	8-21-62	793	953	304	58	65	50	109	152	36	45	50	40	83	114	29	76	53	57	47
WED.	8-22-62	812	988	239	48	55	40	98	127	46	33	40	25	69	89	29	70	50	57	42
THURS.	8-23-62	1,000	1,250	335	52	60	40	131	190	56	37	40	30	92	127	42	70	58	57	42
FRI.	8-24-62	864	1,060	384	62	65	60	162	171	153	48	50	45	123	128	118	76	66	80	57
NO. OF SAMPLES					11						11							12		
4-DAY AVG.		867			22			125			41			92			73	55		
STATION C-2					**7 Miles Below Confluence With Etowah River In Rome, Ga.**													RM	C-278.45	
TUES.	8-21-62	3,165	4,460	2,110	46	70	35	383	602	211	33	55	15	278	450	90	73	43	71	27
WED.	8-22-62	3,054	4,660	1,160	43	55	20	342	663	63	32	44	10	254	540	31	74	48	71	38
THURS.	8-23-62	3,355	4,820	1,960	52	130	35	413	688	243	38	110	15	292	582	121	71	49	89	37
FRI.	8-24-62	3,098	4,560	2,180	39	55	25	322	546	150	27	45	15	230	412	90	71	48	73	31
NO. OF SAMPLES					52						52							25		
4-DAY AVG.		3168			45			365			33			264			72	47		

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

APPROXIMATE SUSPENDED SEDIMENT LOAD

TABLE NO. A-16

Coosa River: - Below Rome, Georgia To State Line

DAY	DATE	TURBIDITY UNITS			TOTAL SUSPENDED SOLIDS						FIXED SUSPENDED SOLIDS					
					CONCENTRATION (mg/1)			MASS (Tons/Day)			CONCENTRATION (mg/1)			MASS (Tons/Day)		
		Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.
		STATION C-3			1.1 Miles Above Rome Kraft - 13.8 Miles Below Confluence With Etowah River									RM	C-268.5	
THURS.	8-23-62	44	47	38	36	45	25	308	385	214	24	30	15	205	257	128
FRI.	8-24-62	42	46	38	37	40	35	316	342	299	22	25	20	180	214	171
SAT.	8-25-62	41	48	30	33	35	25	282	299	214	22	25	15	188	214	128
SUN.	8-26-62	37	48	33	32	35	25	274	299	214	22	25	20	180	214	171
NO. OF SAMPLES		22			21						21					
4-DAY AVG.		41			34			295			22			192		
		STATION C-4			2.1 Miles Below Rome Kraft									RM	C-265.3	
THURS.	8-23-62	49	62	42	39	45	30	334	385	257	25	30	20	214	257	171
FRI.	8-24-62	45	48	40	46	70	35	393	599	299	28	40	20	239	342	171
SAT.	8-25-62	42	48	37	40	45	35	342	385	299	27	30	25	231	257	214
SUN.	8-26-62	42	48	38	42	50	35	359	428	299	28	30	25	239	257	214
NO. OF SAMPLES		21			22						22					
4-DAY AVG.		44			42			357			27			231		
		STATION C-6			3.1 Miles Above State Line - 10.4 Miles Below Rome Kraft									RM	C-256.0	
FRI.	8-24-62	38	44	34	38	60	30	325	513	257	26	35	20	222	299	171
SAT.	8-25-62	39	59	32	36	45	30	309	385	257	27	35	20	231	299	171
SUN.	8-26-62	36	47	24	35	40	30	299	342	257	24	30	20	205	257	171
MON.	8-27-62	35	45	28	32	45	20	274	385	171	20	25	10	171	214	86
TUES.	8-28-62	32	41	25	36	45	25	308	385	214	17	25	10	145	214	86
NO. OF SAMPLES		39			39						39					
5-DAY AVG.		36			35			303			23			195		
		STATION C-7			0.15 Miles Below State Line									RM	C-252.8	
FRI.	8-24-62	37	48	33	34	40	30	291	342	257	21	30	15	180	257	128
SAT.	8-25-62	37	52	28	34	45	30	291	385	257	23	30	20	197	257	171
SUN.	8-26-62	33	41	26	27	35	20	231	299	171	17	20	15	145	171	128
MON.	8-27-62	30	41	24	24	50	15	205	428	128	12	20	5	103	171	43
TUES.	8-28-62	29	35	26	31	35	20	265	299	171	15	20	10	128	171	86
NO. OF SAMPLES		39			39						39					
5-DAY AVG.		33			30			257			18			151		
		STATION BC-1			Big Cedar Creek Outlet - 2.9 Miles Above State Line									RM	CBC-255.8-0.3	
FRI.	8-24-62	37	40	34	34	40	25	5	6	4	19	25	10	3	4	1
SAT.	8-25-62	40	46	32	39	55	30	5	8	4	26	35	20	4	5	3
SUN.	8-26-62	39	47	30	32	55	25	4	8	3	18	35	15	2	5	2
MON.	8-27-62	35	42	28	30	45	15	4	6	2	19	30	5	3	4	1
TUES.	8-28-62	33	37	27	38	40	35	5	5	4	19	20	15	2	3	2
NO. OF SAMPLES		38			36						35					
5-DAY AVG.		37			35			5			20			3		

NOTE: COOSA RIVER - There are no discharge records available for these stations. Therefore, the 4-day average discharge of 3,168 cfs at RM 274.5 (Station C-2) is used to compute approximate Mass in Tons/Day.

BIG CEDAR RIVER - The Cedar River discharges at Cedartown, Ga. are used to compute approximate Mass in Tons/Day, i.e. Q for 8-24 to 28-62 = 53,51,51,50 and 48 cfs.

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

TURBIDITY

TABLE NO. A 37

Oostanaula R. vs. Etowah R. at Rome, Georgia

DAY	DATE	OOSTANAULA R. Mean Daily Discharge (cfs)	OOSTANAULA R. TURBIDITY Concentration (Units)	OOSTANAULA R. TURBIDITY Mass Equivalent (Tons/Day)	ETOWAH R. Mean Daily Discharge (cfs)	ETOWAH R. TURBIDITY Concentration (Units)	ETOWAH R. TURBIDITY Mass Equivalent (Tons/Day)
T	8/8/61	1,560	32	137	2,800	260	1,965
W	9	1,540	37	154	2,800	300	2,268
T	10	1,600	37	160	2,890	360	2,722
F	11	1,460	28	110	2,800	280	2,117
S	12	1,420	23	88	2,600	220	1,544
Sunday	13	1,180	25	80	717	190	368
M	14	1,100	25	74	797	72	155
T	15	1,130	26	79	2,260	66	403
W	16	1,140	27	83	2,260	62	378
T	17	1,120	25	76	2,280	60	369
F	18	1,080	18	52	2,230	50	301
S	19	1,090	22	65	2,160	53	309
Sunday	20	930	19	48	665	48	86
M	21	910	21	52	728	16	31
T	22	1,010	20	54	1,840	22	109
W	23	1,030	22	61	1,950	60	316
T	24	1,040	22	62	2,020	125	686
F	25	1,080	18	52	1,940	190	995
S	26	1,100	21	62	1,860	160	803
Sunday	27	1,100	22	65	735	58	115
M	28	1,130	23	70	690	45	83
T	29	1,170	22	69	1,460	50	197
W	30	1,060	25	72	1,470	140	556
T	31	1,010	25	68	1,440	140	544
F	9/1/61	1,130	22	67	1,510	90	367
S	2	1,430	29	112	1,500	145	587
Sunday	3	1,590	55	236	700	80	151
M	4	1,230	75	249	607	60	98
T	5	1,100	55	163	648	58	101
W	6	1,080	29	85	1,310	120	424
T	7	1,110	36	108	1,390	132	495
F	8	1,120	32	97	1,330	130	467
S	9	1,070	32	92	1,330	90	323
Sunday	10	1,000	26	70	631	60	102
M	11	930	37	93	676	90	164
T	12	933	23	58	1,980	260	1,390
W	13	930	21	53	1,980	280	1,497
T	14	922	21	52	1,990	160	1,719
F	15	916	22	54	2,000	140	756
S	16	969	22	58	1,960	90	476
Sunday	17	910	22	54	612	58	96
M	18	890	23	55	663	95	170
T	19	922	27	67	2,180	140	824
W	20	885	26	62	2,240	160	888

Turbidity Data From Rome, Georgia, City Water Department.

Discharge Data From U.S.G.S.

TABLE NO. A 18

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

MEAN DISCHARGE - By Months

Oostanaula River at Rome, Georgia

Water Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Max.	Min.	Mean	
															cfs	% of Avg.
1960 - 1961	1,592	1,182	2,262	2,482	10,050	9,064	5,098	2,220	4,542	2,649	1,223	993	32,300	790	3,568	104.6
1959 - 1960	1,364	3,035	3,732	4,483	6,767	8,121	4,322	2,017	1,148	881	1,332	1,122	18,400	495	3,183	93.3
1958 - 1959	983	914	1,147	3,444	4,226	4,111	6,148	2,519	3,036	1,508	897	957	14,600	629	2,474	72.5
1957 - 1958	2,338	7,483	5,951	4,063	5,496	5,446	5,506	6,237	1,445	2,954	1,461	1,201	20,500	791	4,123	120.8
1956 - 1957	712	737	2,713	3,527	12,660	5,085	7,964	2,245	2,352	1,372	721	1,961	32,300	442	3,432	100.6
1955 - 1956	834	1,395	1,319	1,156	11,430	6,636	3,509	3,450	1,350	1,400	904	820	20,000	530	3,225	94.5
1954 - 1955	531	637	2,090	3,025	3,049	5,103	6,653	3,512	1,593	1,521	983	579	22,700	408	2,819	82.6
1953 - 1954	638	687	2,706	11,940	2,994	6,244	5,210	2,901	2,007	1,013	1,039	530	28,800	428	3,172	93.0
1952 - 1953	702	1,016	2,479	7,512	3,542	5,736	2,797	5,405	1,283	1,898	789	935	18,400	520	3,310	97.0
1951 - 1952	858	3,036	9,916	7,233	5,272	11,510	3,832	2,233	2,041	935	1,318	1,110	23,100	650	4,119	120.7
1961 Calendar Yr.	819	984	12,610*	2,482	10,050	9,064	5,098	2,220	4,542	2,649	1,223	993	-	-	4,364	128.0
22 Years of Record =													47,000	408	3,411	

10 Year Average Discharge During December = 3,432 cfs.

*Average Discharge During December 1961 = 367% of 10 Year Average.

TABLE NO. A-19

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

SEDIMENTATION - ETOWAH RIVER

Below Allatoona Dam to Kingston, Georgia
(Data furnished by the Mobile District of the Corps of Engineers)

Location	Date	Computed time	Gage height	Mean daily Q cfs	Instant Q cfs	Temperature	Integrated samples suspended sed. P.P.M.
Allatoona Dam	8/9/61	11:40	7.05	2470	8200	73°	9.3
Highway #41	do	-	-	-	-		-
Highway #61	do	16:45	12.79	2640	6970	Estimated	374.3
Kingston, Ga.	do	22:00	9.17	2740	6860		53.3
Allatoona Dam	8/13/61	9:00	1.26	272	272		1.0
Highway #41	do	-	-	-	-		-
Highway #61	do	12:00	4.63	384	430		11.7
Kingston, Ga.	do	16:30	3.62	606	640		5.3
Allatoona Dam	9/14/61	12:00	5.99	1600	6930	63°	1.3
Highway #61	do	15:45	11.17	1760	5270		459.6
Kingston, Ga.	do	19:30	7.85	1980	4940		240.3
Allatoona Dam	9/17/61	8:30	1.18	248	248	Estimated	3.3
Highway #41	do	-	-	-	-		11.3
Highway #61	do	15:15	4.40	361	325		3.3
Kingston, Ga.	9/18/61	8:30	3.36	544	519		9.7
Highway #61	10/25/61	13:00	6.14	700	1370		294.7
Allatoona Dam	10/26/61	12:15	3.07	545	3590	55°	9.3
Highway #41	do	-	-	-	-	Estimated	605.0
Kingston, Ga.	do	20:00	4.52	783	1220		34.0

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

SEDIMENTATION - ETOWAH RIVER

TABLE NO. A-19

Below Allatoona Dam to Kingston, Georgia
(Data furnished by the Mobile District of the Corps of Engineers)
(continued)

Location	Date	Computed time	Gage height	Mean daily: Q cfs	Instant Q cfs	Temperature	Integrated samples suspended sed. P.P.M.
Allatoona Dam	10/29/61	9:00	1.21	256	256		4.3
Highway #41	do	-	-	-	-		3.7
Highway #61	do	10:00	4.41	334	329		18.3
Kingston, Ga.	do	17:15	3.28	495	487		3.3
Allatoona Dam	12/7/61	12:00	7.01	2820	8150	52°	46.2
Highway #41	do	-	-	-	-	52°	47.2
Highway #61	do	13:00	13.09	2980	6200	54°	130.4
Kingston, Ga.	do	18:15	8.68	3210	6120	51°	298.4
Highway #41	12/11/61	-	-	-	-	54°	47.2
Highway #61	do	9:30	5.76	4140	1120	53°	92.2
Allatoona Dam	1/9/62	10:00	7.36	8560	8570	50°	19.8
Highway #41	do	-	-	-	-	Estimated	
Highway #61	do	12:00	14.65	9030	9020		113.8
Kingston, Ga.	do	17:30	10.78	9140	9350		77.8
Allatoona Dam	2/15/62	10:45	6.93	4000	8060	48°	6.2
Highway #41	do	-	-	-	-	48°	21.1
Highway #61	do	13:00	13.67	4220	7940	49°	62.1
Kingston, Ga.	do	17:00	9.25	4390	6980	50°	244.8
Allatoona Dam	2/17/62	18:00	1.24	241	241	48°	8.9
Highway #41	2/18/62	-	-	-	-	48°	7.5
Highway #61	do	9:00	4.76	529	495	50°	27.7
Kingston, Ga.	do	11:20	4.10	892	910	52°	10.8

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

SEDIMENTATION - ETOWAH RIVER

TABLE NO. A-19

Below Allatoona Dam to Kingston, Georgia
(Data furnished by the Mobile District of the Corps of Engineers)
(continued)

Location	Date	Computed time	Gage height	Mean daily Q cfs	Instant Q cfs	Temperature	Integrated samples suspended sed. P.P.M.
Allatoona Dam	3/23/62	11:00	5.67	4470	6540	51°	11.6
Highway #41	do	-	-	-	-	49°	24.1
Highway #61	do	13:00	12.65	4780	6820	54°	76.0
Kingston, Ga.	do	19:45	9.42	5240	7230	53°	92.8
Allatoona Dam	3/24/62	8:00	1.25	248	248	51°	12.7
Highway #41	3/25/62	-	-	-	-	49°	15.4
Highway #61	do	9:15	4.88	613	560	52°	113.1
Kingston, Ga.	do	16:15	4.35	1070	515	56°	31.3
Allatoona Dam	5/3/62	13:30	7.03	4940	8180	58°	16.8
Highway #41	do	-	-	-	-	61°	7.8
Highway #61	do	16:00	14.15	5090	8460	58°	51.9
Kingston, Ga.	do	19:00	10.17	4650	8370	60°	143.9
Allatoona Dam	5/5/62	9:30	1.27	280	272	58°	5.9
Highway #41	do	-	-	-	-	58°	7.6
Kingston, Ga.	do	18:00	4.09	2510	904	60°	10.0
Highway #61	5/6/62	8:00	4.84	665	538	58°	30.7
Allatoona Dam	7/12/62	12:00	5.92	1900	6840	66°	12.0
Highway #41	do	-	-	-	-	67°	139.1
Highway #61	do	17:15	11.27	2100	5370	74°	69.4
Kingston, Ga.	do	18:15	7.84	-	4930	74°	131.3
Allatoona Dam	7/13/62	18:00	1.25	264	248	66°	7.8
Highway #41	7/14/62	-	-	-	-	67°	11.1
Highway #61	7/15/62	9:45	4.81	440	521	72°	20.6

Location By River Mile & Survey Station No.

Allatoona Dam = RM E-47.0 = Near Sta. E-8
Highway No. 41 = RM E-45.1 = 0.1 Miles Above Sta. E-7
Highway No. 61 = RM E-38.2 = 0.8 Miles Below Sta.
Kingston, Ga. = RM E-21.4 = Sta. E-3

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

DISCHARGE

TABLE NO. A-20

SUMMARY 1960-1961 WATER YEAR

Oostanaula River at Rome, Georgia

MONTH		MEAN cfs	MEAN % of Annual Average	MAX. cfs	MIN. cfs
October	1960	1,592	45	4,230	870
November		1,182	33	2,340	830
December		2,262	63	6,800	1,120
January	1961	2,482	70	5,000	1,490
February		10,051	282	32,300	1,480
March		9,064	254	28,600	2,950
April		5,098	143	13,000	2,540
May		2,220	62	3,500	1,750
June		4,542	127	14,500	1,380
July		2,649	74	4,930	1,380
August		1,223	34	1,660	910
September		993	28	1,590	790
Annual Mean		3,568	-	-	-
Max.		-	282	32,300	-
Min.		-	28	-	790

Max. Discharge in February
Min. Discharge in September

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

TURBIDITY - CONCENTRATION

TABLE NO. A-21

SUMMARY 1960-1961 WATER YEAR

Oostanaula River at Rome, Georgia

MONTH		MEAN				
		Arithmetic Avg.				
		Units	% of Annual Average	Weighted Average Units	MAX. Units	MIN. Units
October	1960	47	77	63	160	17
November		17	28	19	50	10
December		46	75	84	280	10
January	1961	30	49	40	140	10
February		97	159	181	370	10
March		74	121	116	290	13
April		58	95	88	190	15
May		31	51	32	130	15
June		156	256	189	430	17
July		119	195	135	490	28
August		30	49	31	62	18
September		28	46	30	75	18
Annual Mean		61	-	116	-	-
Max.		-	256	-	490	-
Min.		-	46	-	-	10

Max. Concentration in June
Min. Concentration in September

COOSA RIVER SYSTEM - GEORGIA-ALABAMA

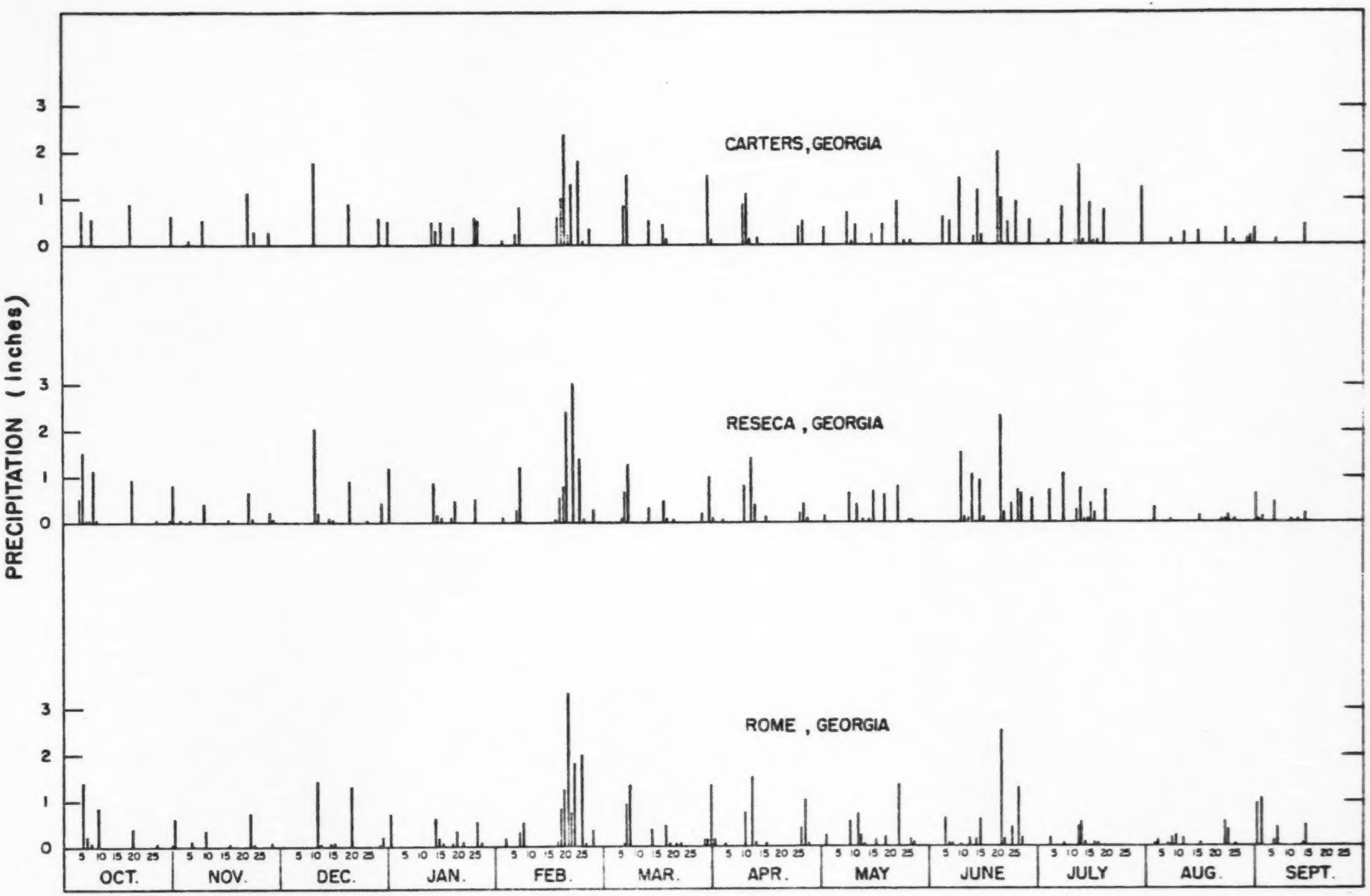
TURBIDITY - MASS TABLE NO. A-22

SUMMARY 1960-1961 WATER YEAR

Oostanaula River at Rome, Georgia

MONTH		MEAN		MAX.	MIN.
		Tons Per Day	% of Annual Average	Tons Per Day	Tons Per Day
October	1960	272	24	1,827	42
November		62	5	312	22
December		511	46	4,642	30
January	1961	266	24	1,890	40
February		4,927	440	17,782	40
March		2,837	254	14,407	106
April		1,211	108	6,318	103
May		194	117	989	75
June		2,315	207	8,910	63
July		996	89	6,522	160
August		103	9	236	52
September		81	7	249	42
Annual Mean		1,119	-	-	-
Max.		-	440	17,782	-
Min.		-	7	-	22

Max. Mass in February
Min. Mass in September

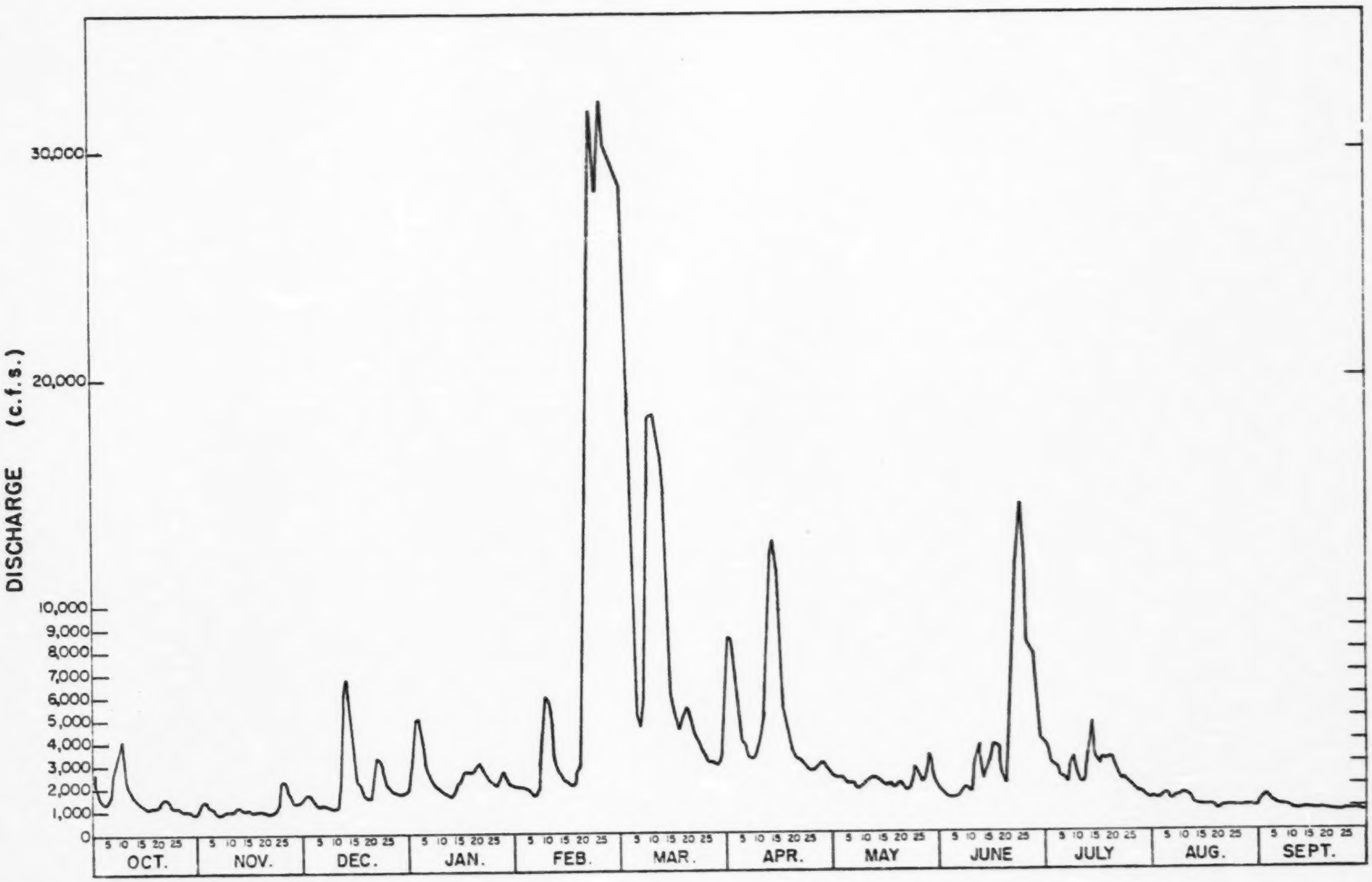


OOSTANAULA RIVER

PRECIPITATION IN DRAINAGE BASIN

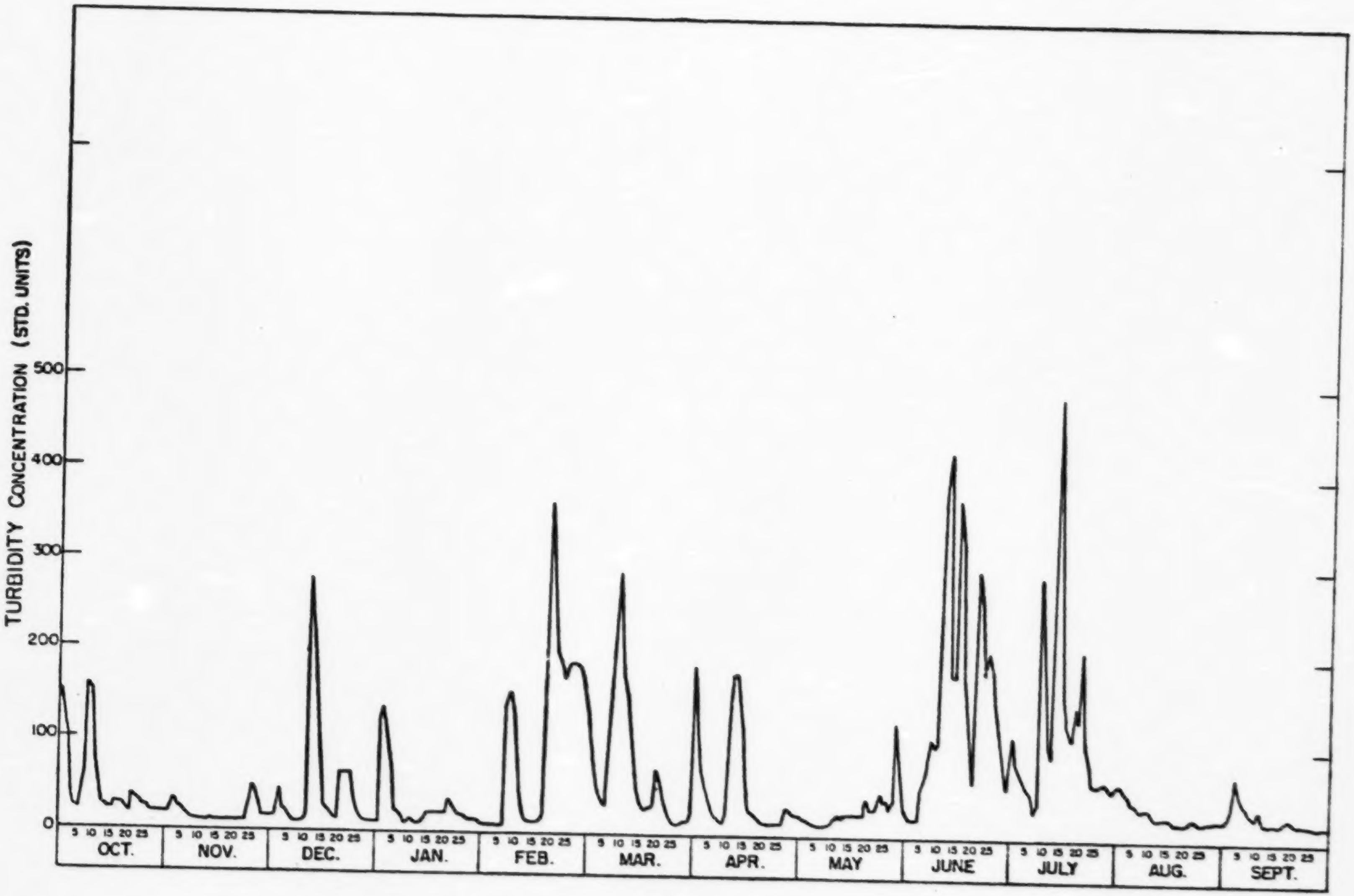
1960 – 1961 WATER YEAR

Figure A-1



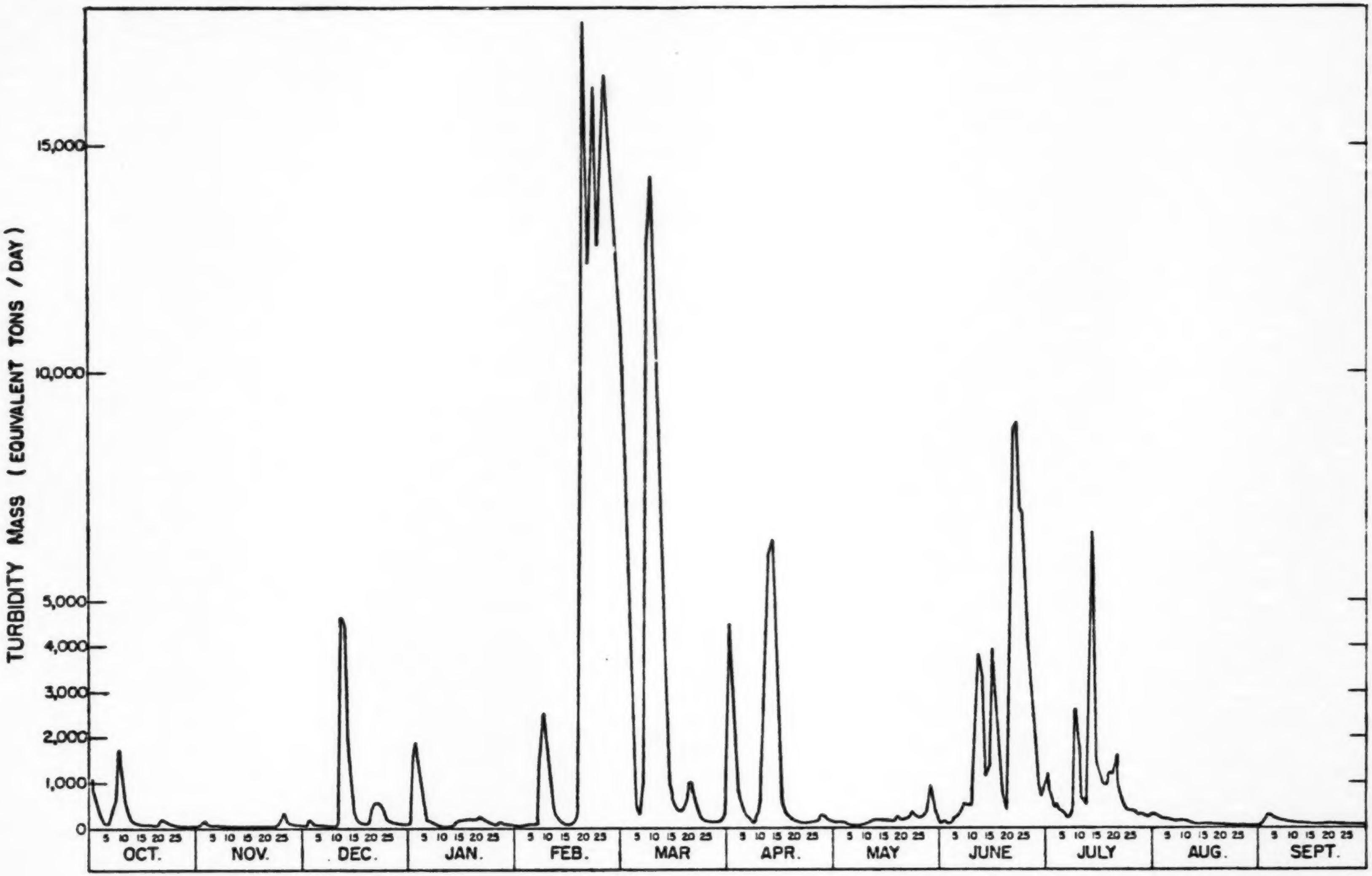
OOSTANAULA RIVER AT ROME, GEORGIA
DISCHARGE
1960 — 1961 WATER YEAR

Figure A-2



OOSTANAULA RIVER AT ROME, GEORGIA
TURBIDITY - CONCENTRATION
1960 - 1961 WATER YEAR

Figure A-3



OOSTANAULA RIVER AT ROME, GEORGIA

TURBIDITY — MASS

1960 — 1961 WATER YEAR

Figure A-4